PROFESSIONAL DEVELOPMENT'S IMPACT ON TECHNOLOGY USE BY K-6 EDUCATORS IN A CHINESE CONTEXT: A MIXED METHODS STUDY

by
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Abstract

K-6 teachers in China face obstacles to using educational technology to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets. This quasi-experimental mixed methods study of primary K-6 teachers at private international schools in China examined outcomes from participation in a technology-focused professional development (PD) program coupled with a community of practice (CoP) relative to their technology self-efficacy, technology competency, technology integration in instruction, and fundamental knowledge of 21st century skills to improve students' 21st century skillsets. Thirty-seven Chinese (n = 20) and international (n = 17) participants from over 20 different contexts engaged in approximately 21 hours of online PD over seven weeks as well as ongoing discussion in an online CoP through the social communication platform WeChat. Program sessions involved multiple multimedia learning approaches (i.e., PowerPoints, articles, videos, etc.) as well as applicable classroom assignments created by participants related to technology integration in the classroom. Participants received feedback on discussion and assignment work from both peers and the program administrator. The researcher employed pre- and post-intervention measures, including the Educator Technology Self-Efficacy Survey, Technology Beliefs and Competencies Survey, PD scale, 21st Century Skills Teaching Scale, Demographic Survey, and Dose Received Survey. Qualitative data were collected from interview protocols, field notes, and artifacts to understand whether participation in the online PD and CoP impacted participating educators related to their technology integration knowledge and abilities. Findings suggested context varies in the level of support associated with technology integration. The majority of participants highlighting an absence of PD support but varied situations regarding infrastructure, financial, and administrative support in their contexts.

A comparison of pre- and post-intervention data with a paired sample *t* test revealed a statistically significant growth in participants' technology self-efficacy but no significant improvement in reported technology competency, perceptions of technology integration, perceptions of PD, and 21st century skills knowledge. Qualitative data, however, revealed growth in technology integration and PD as well as 21st century skills knowledge.

Additionally, these data described the WeChat CoP as supportive of participants' engagement in the online PD program. Participants maintained a low rate of participation, which decreased throughout the program due to program workload, accessibility, focus of program content, applicability of content, and participation of the cohort. These key factors require future consideration and research when employing an online PD program. As educational implications, schools need to consider content and grade-level alignment. Also, it is important that schools deliver PD in a longitudinal fashion with ongoing follow-up that focuses on engagement strategies to maintain participation.

Keywords: technology integration, professional development, 21st century skills

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The student has made all necessary revisions, and we have read, and approve this dissertation for submission to the Johns Hopkins Sheridan Libraries as partial fulfillment of the requirements for the Doctor of Education degree.

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Dedication

This dissertation is dedicated to my family:

To my father, William S. Boland, who has been a creative guiding force and inspiration my entire life.

To my mother, Deborah A. Boland, who has been a wonderful supporter of my wildest notions.

To my niece, Arianna McCarthy, who I hope this shows that anything is possible.

And finally, to my wife, Lorna, who has supported be in the worst of times with humor, love, encouragement, optimism, encouragement, and a smile.

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Executive Summary

Classroom learning experiences that are student-driven and technology-supported help students to develop valuable 21st century skillsets necessary to be successful in today's global workplaces, cultivating collaboration, communication, creativity, and critical thinking skills (Association for Career and Technical Education [ACTE], 2010; Bellanca & Brandt, 2011; Ertmer & Ottenbreit-Leftwich, 2010; Partnership for 21st Century Skills, 2005). Several aspects of a 21st century educational experience also include information literacy; media literacy; and information, communications, and technology literacy, which all help prepare students to tackle complex challenges (ACTE, 2010). An absence of these skillsets can leave students unprepared to be competitive with their peers as they progress through school and tackle 21st century challenges. For students to develop these skillsets, however, their teachers must have the requisite skills to employ successful strategies in the classroom to foster their development. Teachers, however, currently struggle to help develop these skills in their students (Jonassen, Howland, Moore, & Marra, 2003; Lowyck & Elen, 2004), particularly in a Chinese context (Zhao, Wang, Wu, & He, 2011).

Technology-focused professional development (PD) programs can help provide educators with the necessary and requisite skills to employ successful educational strategies with their students (An & Reigeluth, 2014; Li, Rao, & Tse, 2012; Liang et al., 2007; Spires, Morris, & Zhang, 2012). High-quality, technology-focused PD can positively benefit teacher technology self-efficacy (Cheung, 2008; Li et al., 2012; Long, Liang, & Yu, 2013), proficiency (Chang, 2012; Dawson & Rakes, 2013; Li, 2006; Zhou, Zhang, & Li, 2011), instructional practices (An & Reigeluth, 2014; Li et al., 2012; Liang et al., 2007; Spires et al., 2012), and teacher knowledge of 21st century skills (Ertmer & Ottenbreit-Leftwich, 2010; Tay, Lim, & Lim, 2015). This quasi-

experimental mixed methods study investigated how participation in an online PD and community of practice (CoP) program focused on technology integration might support the improvement of K-6 educators' technology self-efficacy, competency, and integration in instruction as well as fundamental knowledge of 21st century skills to implement instructional practices that foster students' 21st century skillsets.

Problem of Practice

Chinese schools fail to meet international standards related to the cultivation of 21st century skills (Zhao et al., 2011), and teachers struggle to address these contemporary challenges for their students (Jonassen et al., 2003; Lowyck & Elen, 2004). Several obstacles persist for Chinese and international teachers concerning integrating technology effectively into instruction in K-6 environments (Liang et al., 2007; Sang et al., 2011; Zhang, 2007; Zhou et al., 2011). A historical review exposes ongoing cultural and sociological problems in China related to using any instructional methodology based on student-centered, constructivist philosophy (Li, Rao, & Tse, 2012). These issues result from China's pedagogical traditions inspired by Confucian philosophy, which remains a powerful influence in Chinese society and focuses on a behaviorist model of expert-led, guided instruction (Li et al., 2012), therefore influencing teacher pedagogical beliefs and practices (Zhou et al., 2011). Although the Chinese government implemented many reforms to address educational technology shortcomings since the 1980s, few have been successful (Liang et al., 2007). Schools need updated technology and improved infrastructure (Liang et al., 2007) as well as sufficient inservice PD and preservice training (Zhou et al., 2011). Principal leadership currently does not effectively guide this PD, nor does it provide a vision or implementation plans for technology integration policies (Chang, 2012; Li, 2006; Machado & Chung, 2015).

Theoretical Framework

Ecological systems theory (EST) provides the foundation to support the framing and organization of the study's factors, helping us understand their relationships, specifically a networked model suggested by Neal and Neal (2013). Neal and Neal elaborated the nested model to a networked model of overlapping, interconnected social interactions involving a focal individual. These authors considered the multitude of social system interactions and patterns of interactions an individual encountered, directly and indirectly, illuminating a complex network of factors and processes within different connected environmental systems.

Background and Context

In today's modern classrooms, students are presented with varied ways to enhance learning through innovative technologies. Technology is a large part of students' lives, and they are influenced and shaped by it through their daily communication, interactions, and learning experiences (Gu, Zhu, & Guo, 2013; Pedró, 2006). Additionally, workplaces require employees to be well versed in emerging technologies and advanced problem-solving skills to address complex issues, produce innovative solutions, work in integrated teams, and adapt to new situations (ACTE, 2010; Ertmer & Ottenbreit-Leftwich, 2010; Partnership for 21st Century Skills, 2005). It is essential that students become accustomed to these new literacies and technology challenges as early as possible through effective technology-enhanced, student-centered learning experiences (ACTE, 2010; Ertmer & Ottenbreit-Leftwich, 2010). These experiences seamlessly integrate technology into the learning process with students driving the educational experience and therefore preparing them with the 21st century skills necessary for the future job market.

Barriers to the effective integration of technology in K-6 schools in China continue to hinder educators' capacities to foster these learning experiences (Liang et al., 2007; Sang, Valcke, van Braak, Tondeur, & Zhu, 2011; Zhang, 2007; Zhou, Zhang, & Li, 2011). Effective technology use is not a China-exclusive issue, however, with research noting the absence of effective technology integration in many international environments (Ertmer & Ottenbreit-Leftwich, 2010; Mueller, Wood, Willoughby, Ross, & Specht, 2008; Tondeur, van Braak, & Valcke, 2007). Without technology-enhanced, student-centered learning experiences, student learning of essential 21st century critical thinking skills may be negatively impacted (Bellanca & Brandt, 2011; Trilling & Fadel, 2009). To adequately prepare its students with 21st century skillsets, China needs to address the barriers to technology integration that currently exist for teachers.

A Needs Assessment Investigation

The purpose of the needs assessment study was to investigate factors that influenced the technology integration of teachers in a K-6 international school in a Chinese setting. I invited all teaching staff of Beijing Primary School (BPS), a pseudonym, to participate. The participants included 16 of 22 Chinese and international teachers working in K-6 classrooms and one principal. I collected quantitative and qualitative data simultaneously using a survey and two interview protocols.

The participants in the needs assessment study revealed that they support the idea of cultivating 21st century skillsets using technology-enhanced, student-centered learning experiences. However, they need to increase their technology self-efficacy, competency, and instructional practices as well as their knowledge of 21st century skills to offer better support to their students. First, teachers requested experience through which they might increase their knowledge and experiences using technology to improve their self-efficacy. Second, teachers desired more practice and hands-on experience with technology tools. Finally, participants universally expressed the need for technology-focused inservice PD to improve their technology skillsets.

Intervention Theoretical Framework

A dual theoretical framework supports the selection of the PD intervention. Social cognitive theory provides a lens on high-quality, effective PD, which involves authentic learning experiences in which learners are active participants in their education process. Situated learning theory focuses on the interdependent relationship between the individual and the world associated with the process of learning, cognition, and understanding and emphasizes the social phenomenon of meaning-making and coming to understanding of a phenomenon through participation in communal activity, practice, and thought (Lave, 1991). Situated learning theorists hold that learning occurs in a community of practice (CoP), where members can interact with peers and share knowledge.

Learning Support Interventions

PD programs can positively impact teacher's technology integration skillsets if they address the effective PD components highlighted amongst a synthesis of seminal studies, notably proper duration (Davidson et al., 2009; Yoon et al., 2007), a learner-centered focus on classroom-related content (Desimone & Garet, 2015; Vavasseur & Kim MacGregor, 2008), engagement through actively experiencing technology tools (Desimone & Garet, 2015; Hu et al., 2014), a collaborative environment (Lock, 2006; Swan & Dixon, 2006), and long-term, sustained support (Claesgens et al., 2013; Henderson, 2007) through an established CoP (MacDonald, 2008; Vavasseur & Kim MacGregor, 2008). Additionally, PD programs also can account for several context-relevant logistical components, including strong organizational structure, alternative strategies to overcome technical challenges when they arise, adequate workload, linear structure, and a comprehensive orientation program (Jayatilleke et al., 2017) as well as the inclusion of teacher concerns and voices (Donovan et al., 2007; Yan & He, 2012). When delivered in an efficient, well-planned, reoccurring, and high-quality approach with follow-up, PD allows educators to be more successful in fostering student achievement (Borko, 2004; Darling-Hammond, 1999; Garet et al., 2001; Law et al., 2008; Lawless & Pellegrino, 2007; Li et al., 2012), and an online PD program with a CoP component has the potential to have a powerful impact in a Chinese context.

Research Purpose and Objective

The purpose of this study was to examine the effect of an online PD and CoP program to improve K-6 educators' abilities to implement instructional practices that potentially foster students' 21st century skillsets. A PD program was employed to affect teachers' self-efficacy, technology competency, technology integration in instruction, and fundamental knowledge of necessary 21st century skills for students. Further, it was theorized that these teacher changes would lead to improved student engagement, growth of student technical skills, enhanced use of 21st century skills, and eventually lead to increased student achievement as a long-term outcome. The research questions for this study included both process and outcome questions.

Process Research Questions:

RQ1: How do participants describe their context relative to support for technology integration to support 21st century learning?

RQ2: What was the enacted PD and CoP program and to what extent was it implemented with fidelity?

RQ3: What were the participants' experiences within the online PD and CoP program?

RQ3a: What were participants’ perceptions of the beneficial or adverse effects of participating in the technology-focused PD and CoP program?

RQ3b: What components of the technology-focused PD and CoP program do participants perceive as having the greatest value for their development regarding technology self-efficacy, technology competency, technology integration in instructional practices, and knowledge of 21st century skills?

RQ3c: What suggestions for improvements do participants have regarding technology-focused PD and CoP program?

RQ3d: What are the relationships between individual characteristics (i.e., technology self-efficacy) and contextual factors (i.e., principal leadership support and resource support) and their experience in the technology-focused PD and CoP program?

Outcome Research Questions:

RQ4: To what extent do participants report changes in their technology self-efficacy, competency, and instructional practices following the technology-focused PD and CoP program?

RQ5: How did the participants’ perceptions change regarding PD following the technology-focused PD and CoP program?

RQ6: What were participants’ perceptions of the impact of the technology-focused PD program on their knowledge of important 21st century skills?

RQ7: To what extent do foreign and local participants differ in their reported technology self-efficacy, technology instructional practices, perceptions of PD, and knowledge of 21st century skills following a technology-focused PD and CoP program?

Research Design

This study employed a quasi-experimental pretest-posttest design using a convergent mixed methods data collection process as the integration of mixed methods enhances credibility (Bamberger, Tarsilla, & Hesse-Biber, 2016). Data were collected concurrently and triangulated using this design. It also allowed for the establishment of an appropriate counterfactual condition, comparing the same participants at two points in time before and after the intervention (Wiggins, 2018). The rationale for this selection included triangulation of data through convergence and corroboration, complementarity through elaboration upon findings, initiation to potentially reframe research questions, and expansion of the research breadth through both methods (Johnson & Onwuegbuzie, 2004; Onwuegbuzie & Leech, 2006).

Intervention

Thirty-seven Chinese (n = 20) and international (n = 17) participants from over 20 different contexts engaged in approximately 21 hours of online PD over seven weeks as well as ongoing discussion in an online CoP through the social communication platform WeChat. Program sessions occurred on the online platform Blackboard Learn and involved multiple multimedia learning approaches (i.e., PowerPoints, articles, videos, etc.) as well as applicable classroom assignments created by participants. Participants received feedback on discussion and assignment work from peers and the program administrator.

Data and Data Analysis

Data were analyzed simultaneously following the convergent mixed methods design. The statistical analyses included descriptive statistics, paired sample *t* tests, and Mann-Whitney U tests. For qualitative data, I employed a thematic coding hybrid approach that included both inductive and deductive coding as detailed by Fereday and Muir-Cochrane (2006). Once I analyzed the quantitative and qualitative data separately, I then analyzed the data together, searching for areas of triangulation of significant themes and trends.

Findings

Participant statements highlighted a generally negative view of administrative support and technology school planning in their contexts, noting an absence of both. Additionally, participants' responses identified an absence of both past and present PD experiences for participants related to technology as well as other areas. Infrastructure and technology tool access varied widely across contexts, allowing me to identify no apparent similarities. Although participants also detailed technology support systems, staff, and budgeting as absent from most contexts, they described a generally positive culture toward technology in their schools.

Participation rates were low with the program and posed a validity issue. Participation and engagement, which started relatively high, declined with each consecutive session, resulting in a lack of completion amongst participants. Enthusiasm and motivation, however, remained high in the CoP, which emerged as the focal point of the program according to participants due to their ability to interact. This finding was of particular importance considering the high usage of WeChat in a Chinese context, potentially highlighting an area of focus for future PD efforts. Additionally, participants maintained little implementation of the program's content in their classrooms with many suggesting that they may employ it in the future.

Participants, however, maintained a favorable view of the program, noting its high-quality content, resources, and support team. They highlighted several factors contributing to their decline of participation, including personal demands and work schedules, the program's excessive workload, technical connection issues, and the collective impact of decreased participation. These key findings point toward the need for future research to consider a workload and length balance and a potential avenue to avoid engagement issues, which WeChat mitigated as noted previously. Participants suggested six areas of improvement for future PD programs, including (a) directly applicable classroom content, (b) more focused content based on student grades/ages, (c) less content in general, (d) necessary cultural adaptations for Chinese participants, (e) addition of a blended approach, and (f) methods to combat low participation.

A comparison of pre- and post-intervention data with a paired sample revealed a statistically significant increase in participants' technology self-efficacy as well as a trend toward the growth of perceptions of technology integration but no significant improvement in technology competency, perceptions of PD, and 21st century skills knowledge. Participants statements supported the growth in their self-efficacy but noted that more hands-on experiences could increase it further. Responses highlighted the WeChat CoP as important for technology competency because it allowed for a community space for sharing knowledge. Participants also expressed a general weariness with moving forward with technology integration without more practical experience. Participant statements related to perceptions of PD and 21st century skills knowledge, however, differed from the quantitative data, expressing a more favorable impression of both as a result of the program while also highlighting the workload as too heavy.

A comparison of Chinese and international participants revealed a minimal trend toward a difference in perceptions of technology integration abilities favoring Chinese participants and no significant difference regarding teacher technology self-efficacy, perceptions of technology integration abilities, perceptions of PD, and 21st century skills knowledge. Participants statements regarding perceptions of PD, however, did not reflect the quantitative data as a larger number of international participants expressed positive comments than Chinese.

Overall, these findings describe a contextual environment that is facing multiple barriers to technology integration. Participant statements and research literature are consistent on four key factors impacting technology integration in Chinese schools: infrastructure (Tan, 2010; Wan, 2012; Wenbin, 2012), user knowledge (Figg & Jaipal, 2011; Li et al., 2012; Mishra & Koehler, 2006), school management and PD support (Chang, 2012; Li, 2006; Machado & Chung, 2015), and educational philosophy (Kim et al., 2013; Lee et al., 2013; Liu & Feng, 2015). The barriers described in the data coincided with similar obstacles highlighted in the needs assessment study findings as well as the Chapter One literature review and conceptual model (see Figure 1.2). Although the PD program was somewhat successful in improving its four key areas of focus, the lack of participation and completion negatively impacted these potential benefits. Ongoing PD support emerged as necessary to enhance participants' abilities, and future research should consider the increased integration of practical and applicable content for educators to apply in their classrooms.

Chapter One

Technology Integration in Chinese Primary Classrooms

In today's modern classrooms, students are presented with a multitude of different manners to enhance learning through innovative technologies. Technology is a large part of their lives, and they are influenced and shaped by it through their daily communication, interactions, and learning experiences (Gu, Zhu, & Guo, 2013; Pedró, 2006). These technologies have not only permeated schools but have expanded to the job market, offering a wealth of new challenges and requesting updated skillsets. Workplaces require employees to be well versed in emerging technologies and advanced problem-solving skills to address complex issues, produce innovative solutions, work in integrated teams, and adapt to new situations (Association for Career and Technical Education [ACTE], 2010; Ertmer & Ottenbreit-Leftwich, 2010; Partnership for 21st Century Skills, 2005). It is essential that students become accustomed to these new literacies and technology challenges as early as possible through effective technology-enhanced, student-centered learning experiences (ACTE, 2010; Ertmer & Ottenbreit-Leftwich, 2010) to prepare them to compete in the global economy successfully (Partnership for 21st Century Skills, 2005). These experiences seamlessly integrate technology into the learning process with students driving the educational experience and therefore preparing them with the 21st century skills necessary for the future job market.

Students need additional support to develop the necessary skillsets to prepare them for higher education, the global job market, as well as civic responsibility (ACTE, 2010). Academic competencies, 21st century skills, and technical knowledge should be fully integrated for students in a holistic educational learning experience (ACTE, 2010). With demand rising worldwide for "knowledge technologists" (ACTE, 2010, p. 9), it is imperative that schools provide an educational experience enhanced with emerging technologies to prepare students for post-secondary education and future career readiness. Some 21st century student outcomes indispensable for this preparation include learning and innovation skills involving critical thinking, communication, collaboration, and creativity (ACTE, 2010). An essential aspect of a 21st century educational experience also incorporates information literacy; media literacy; and information, communications, and technology literacy to prepare students to tackle new, complex challenges (ACTE, 2010). These skills are important for teachers to integrate into their instruction to foster the necessary skills for students to be successful.

Barriers for teachers to the effective integration of technology into instruction in K-6 schools in China to support student learning continue to hinder educators' capacities to foster these technology-enhanced, student-centered learning experiences (Liang et al., 2007; Sang, Valcke, van Braak, Tondeur, & Zhu, 2011; Zhang, 2007; Zhou, Zhang, & Li, 2011). Schools in China struggle to maintain pace with international standards that equip students with necessary 21st century competencies to compete in the global economy (Kay & Greenhill, 2010; Spires, Morris, & Zhang, 2012). Effective technology use is not a China-exclusive issue, however, with research noting the absence of effective technology integration in many international environments (Ertmer & Ottenbreit-Leftwich, 2010; Mueller, Wood, Willoughby, Ross, & Specht, 2008; Tondeur, van Braak, & Valcke, 2007). Without technology-enhanced, student-centered learning experiences, student learning of essential 21st century critical thinking skills may be negatively impacted (Bellanca & Brandt, 2011; Trilling & Fadel, 2009). Instruction using technology as a tool to support learning can cultivate deeper comprehension through engagement in team learning and enhanced critical thinking, preparing students to tackle more advanced challenges (An & Reigeluth, 2014; Jonassen et al., 2003; Lowyck & Elen, 2004; Trilling &

Fadel, 2009). To effectively prepare its students with 21st century skillsets for the global economy, China needs to address the barriers to technology integration that currently exist for teachers. The problem of practice outlines the current issues within the study's context.

Problem of Practice

Technology-enhanced, student-centered learning experiences help students to cultivate valuable 21st century skillsets (Bellanca & Brandt, 2011; Partnership for 21st Century Skills, 2005). These skillsets are necessary for 21st century workplaces, requiring emerging technologies expertise, advanced critical-thinking skills to tackle complicated problems, innovative ideas and thinkers, and flexible team players (ACTE, 2010; Ertmer & Ottenbreit-Leftwich, 2010). Chinese schools fail to meet international standards related to the cultivation of these 21st century skills to compete in the ever-increasing global market (Zhao et al., 2011), and teachers struggle to address these contemporary challenges for their students (Jonassen et al., 2003; Lowyck & Elen, 2004).

In China, several obstacles persist for Chinese and international teachers with respect to integrating technology effectively into instruction in K-6 environments (Liang et al., 2007; Sang et al., 2011; Zhang, 2007; Zhou et al., 2011). A historical review exposes ongoing cultural and sociological problems in China of using any instructional methodology rooted in student-centered, constructivist philosophy (Li, Rao, & Tse, 2012). These issues result from China's pedagogical traditions rooted in Confucian philosophy, which remains a powerful influence in Chinese society and focuses on a behaviorist model of expert-led, guided instruction (Li et al., 2012). Although many reforms to address educational technology shortcomings have been implemented since the 1980s, few have been successful (Liang et al., 2007). Many Chinese teachers possess little experience using technology to support student learning and maintain pedagogical beliefs that conflict with constructivist principles and student-centered activities (Zhou et al., 2011). Schools need updated technology and improved infrastructure (Liang et al., 2007) as well as sufficient inservice PD and preservice training (Zhou et al., 2011). Principal leadership currently does not effectively guide this PD, nor does it provide a vision or implementation plans for technology integration policies in the school and curriculum (Chang, 2012; Li, 2006).

Theoretical Framework

Ecological systems theory (EST) provides the foundation to support the framing and organization of the study's factors, helping us understand their relationships. Specifically, a networked model of factors suggested by Neal and Neal (2013), which evolved from the original Bronfenbrenner (1994) EST model and Simmel's (1955 [1922]) notion of intersecting social circles, supports the organization of the factors that relate to the problem of practice. Bronfenbrenner and Morris (2006) further developed the idea of nested environments from the viewpoint of the person in question with each higher structure impacting the ecological systems beneath it. Neal and Neal elaborated the nested model to a networked model of overlapping, interconnected social interactions involving a focal individual. These authors considered the multitude of social system interactions and patterns of interactions an individual encountered, directly and indirectly. This description illuminates a complex network of factors and processes within different connected environmental systems that should be considered in relation to the problem of practice taken up in this dissertation.

A networked systems approach highlights the complexity of factors that both facilitate the implementation of technology as well as create barriers for teachers' technology integration to support students' development of 21st century skills. Examining the issue from the networked model proposed by Neal and Neal (2013) and focusing on students, several overlapping systems develop (e.g., micro, meso, exo, and macro), each impacting students through various direct and indirect social interactions. As the foundation of EST is the setting or context, Neal and Neal defined these environments as groups of interacting individuals and described their networked model as a series of overlapping structures in which these social interactions occur. This description highlights the social interactions of the focal individual, determining how the systems connect to one another (Neal & Neal, 2013). The networked model redirects the focal point from where individuals interact in Bronfenbrenner's (1994) EST model and instead concentrates on how and with whom the focal individual interacts, allowing for the investigation of complex system interactions of overlapping factors (Neal & Neal, 2013).

From an EST perspective, the incorporation of technology compares to the ecological example of the zebra mussel problem in the Great Lakes (Zhao & Frank, 2003). These authors tackled the issue from the complex introduction of a foreign species into an unfamiliar environment. Despite substantial investment and support, technology has failed to take robust and widespread root in schools, particularly in a Chinese context (Liang et al., 2007; Zhou et al., 2011). A thorough, systematic approach is necessary to study interactions among several factors, including the environment, attributes of the species, and outside influential elements (Zhao & Frank, 2003). Schools represent a very complex organism with many interacting and nested factors. By viewing the factors through an EST networked framework, it is easier to study the ongoing complexities and developments with education organisms. Figure 1.1 displays the networked systems framework of this study and its application to the Chinese and Beijing Primary School (BPS), a pseudonym selected for the needs assessment study context.

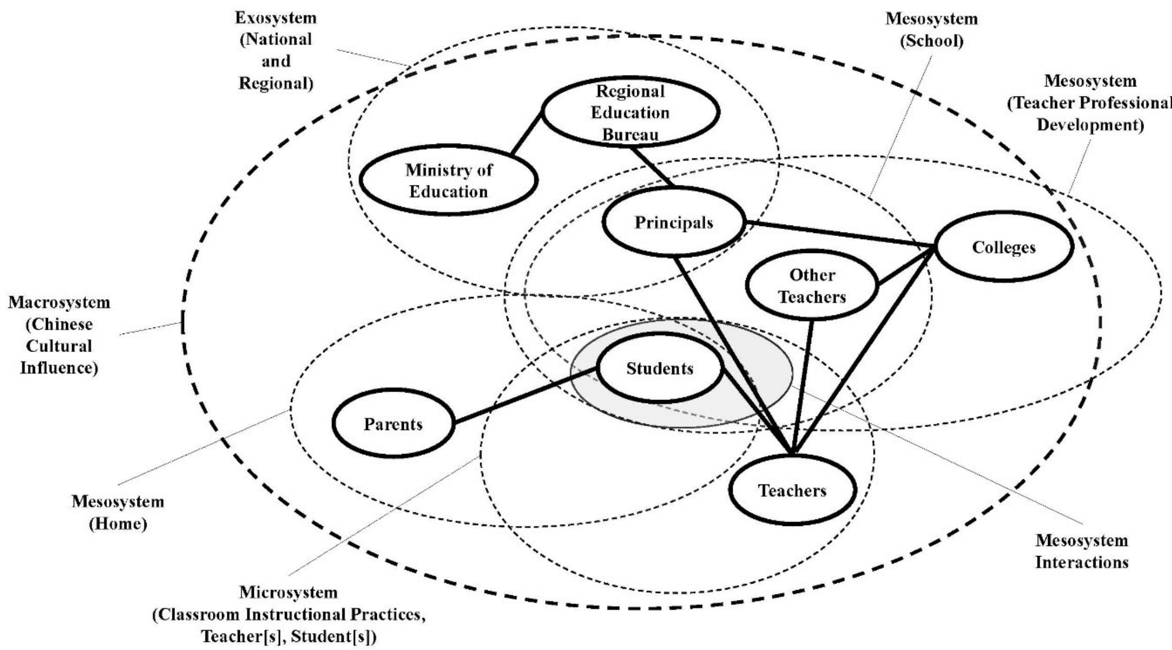


Figure 1.1. Networked Systems Theoretical Framework

Table 1.1 identifies the networked systems and the factors included in the context. A narrative description defining each system follows. In this section, I briefly overview the factors related to the theoretical perspective and each system, and in the next section, I delve into more in-depth detail regarding how each factor impacts the problem of practice.

Table 1.1

Networked Systems Table Breakdown

System	System Level	Factors
Chinese Cultural Influence	Macrosystem	Chinese societal norms
National and Regional	Exosystem	historical government reforms and policies, infrastructure and resources
School	Mesosystem	principal leadership

Teacher PD	Mesosystem	inservice PD and preservice training
Home	Mesosystem	parental perceptions of education
Teacher(s)	Microsystem	teacher epistemological beliefs, teacher knowledge, teacher pedagogical beliefs, teacher self-efficacy
Classroom Instructional Practices	Microsystem	instructional practices
Student(s)	Microsystem	student beliefs about technology as an instructional tool, student self-efficacy for learning using technology as a tool, student perceptions of learning

At the macrosystem level, Chinese culture and societal norms exert a powerful influence on the education system, impacting aspects of what teachers believe regarding knowledge acquisition as well as how and what they teach (Mingyuan, 2006), and create a network of factors dependent on one another. Chinese culture defines the social patterns and interactions of the smaller systems through its powerful influence, which impacts all aspects of Chinese society. Due to the significant impact Chinese culture has on all aspects of society (Mingyuan, 2006), it is essential to understand its influence on the subsystems of the networked model and therefore allow for a deeper understanding to how the numerous factors impact educators directly and indirectly. For example, the influence of Confucianism (Law, 2007; Mingyuan, 2006; Zhang, 2007) and its effect on pedagogical beliefs and therefore instructional practices is key to understanding the problem of practice and its association with teachers. More comprehensive details of this relationship are in the following section.

The exosystem includes the government reforms and policies implemented by the Chinese government that have impacted education. Additionally, it consists of the Ministry of Education (MOE) and the Education Bureau and how their regional and national policies influence the infrastructure and resources available to schools and teachers. It also includes socioeconomic disparities in rural and urban areas that resulted from unbalanced educational reforms and policies related to financial investment and school organization. The policies implemented by MOE and regional education bureaus influence schools' education practices and leadership, as well as the resources available to educators. Policies from MOE affect the regional curriculum standards and how teachers can instruct students due to their influence on professional learning policies and programs as well as what curricula schools can employ. Additionally, government reforms and policies significantly impacted the foundation of today's Chinese education system by outlining the policies driving the development of the education sector as well as the funding to support these initiatives.

The mesosystem represents the convergence of interactions of the other systems (Neal & Neal, 2013) on teachers in China as well as the BPS school, including the specific school infrastructure and resources, principal leadership, inservice PD and preservice training, and parental perceptions of education in the home. The combined interaction of these components impacts all teachers in China in a complex, interconnected manner because they contribute to teacher access to technology as inservice PD and preservice training impact their ability to use technology effectively. Additionally, the influence of the home through parental interactions also impacts teachers' approaches to educating their students as pressure from parents can affect the strategies teachers' employ (Law, 2007). This interaction includes the overlap between the different microsystems noted in the next section and involves additional social interactions and proximal processes experienced by the teacher.

The microsystem includes teacher beliefs (e.g., teacher epistemological beliefs, teacher knowledge, teacher pedagogical beliefs, and teacher self-efficacy), classroom instructional practices, and student beliefs (e.g., student beliefs about technology as an instructional tool, student self-efficacy for learning using technology as a tool, and student perceptions of learning). Factors in the microsystem involve direct social interaction with the individual (Neal & Neal, 2013). In the present study, this interaction involves Chinese and international teachers in a Chinese international school context. Each of these microsystems directly affects teachers through a complex interaction of proximal processes and are of crucial importance to understanding the problem of practice. The following narrative will provide an in-depth analysis of the various levels within the networked framework depicted in Figure 1.1. Starting with the macrosystem and moving to microsystems, it will highlight the critical factors that influence the problem of practice.

Factors Related to Technology Integration in Instructional Practices

Five general qualities help determine the acceptance of an innovation, including perceived or relative advantage over previous ideas, compatibility with existing values and practices, simplicity and ease of use, trialability, and observable results (Rogers, 2003). These five qualities represent essential components of consideration for the integration of any innovation, such as the acceptance of new technology tools in a school. Rogers (2003) emphasizes that reinvention is a fundamental component of introducing new inventions, describing how success depends upon it meeting the needs of key stakeholders. Peer-to-peer conversations and peer networks also play a pivotal role in the promotion of an innovation, demonstrating the vital role that students and teachers play in influencing their peers regarding technology adoption. Rogers also details five different populations tied to innovation, including innovators, early adopters, early majority, late majority, and laggards. Understanding the appropriate interactions with these diverse groups is critical for the promotion of an innovation. Rogers describes the importance all stakeholders play in the integration of innovative technologies in a school, similar to the ideas highlighted earlier in the networked systems theoretical framework, and points researchers toward the essential initial step of identifying the factors that serve as barriers to the incorporation of an innovation.

Macrosystem: Chinese Cultural Influence

The macrosystem involves the influence Chinese culture places upon and societal norms expected of the education community, specifically teachers. Understanding the powerful influence of Chinese culture on the education system is essential to properly examine any problem of practice within China (Mingyuan, 2006). This discussion includes how Chinese culture and societal norms influence stakeholders in subsystems within the macrosystem, which sheds further understanding on their effect on educators in China, specifically regarding the culture's integration of Confucian philosophy.

With a foundation of Confucian philosophy, China developed an education culture supported by students, educators, and families. In traditional Chinese society, Confucianism "emphasizes imposing in young children a sense of conformity, discipline, self-control, love of hard work, and academic achievement" (Li et al., 2012, p. 615). Confucianism supports the idea that knowledge originates from authority, fundamentally impacting approaches to learning, teaching, and thinking in many Chinese people (Lee, Zhang, Song, & Huang, 2013; Li et al., 2012; Wang & Du, 2014). This approach operates as a highly prioritized nationwide effort in the education system (Mingyuan, 2006). In an analysis of the impact of traditional Chinese culture on education, Mingyuan (2006) concluded that government policies and family life cultivate an intensively competitive atmosphere, embracing a goal of "revitalizing the nation through education" (p. 171). The Chinese desire to raise the national quality of scholarship of their society, believing well-educated, law-abiding citizens are the future of China (Fees, Hoover, & Zheng, 2014; Woronov, 2008).

Another influential factor from the Chinese cultural perspective is collectivism, which has emerged as the dominant ideology in China with individual interests placed second (Zhang, 2007). A teacher-dominated pedagogical culture with expert-led lectures to large groups emerged from this philosophical viewpoint as well as social elements, including the economic and political systems (Zhang, 2007). A cultural foundation of goals based on this philosophy created resistance to the integration of technology that would necessarily lead to more constructivist, student-centered environments (Ely, 1999; Hew & Brush, 2007; Wu, Hsu, & Hwang, 2007). Confucian pedagogical philosophy embedded in Chinese traditional culture continues to have a strong indirect influence on the Chinese education system as well as teachers and their practices.

Further, the word *obedience* came to summarize the culture of the Chinese education system, fostering an image of an unquestioning, respectful student (Mingyuan, 2006). One of the first lessons taught to Chinese students in school regarding learning behavior focuses on conformity (Rajaram, 2013). Conforming to the norms of the social collective and never challenging the teacher are imperative, operating opposite to ideas of constructivism. Teachers represent authority and expert knowledge transmitters, therefore requiring the deference and respect of students within the Confucian culture (Chan & Elliot, 2004; Lee et al., 2013).

Home life encourages similar values of filial piety, quiet dignity, and respect within the patriarchal society (Mingyuan, 2006), which are elements of the home interactions within the mesosystem. An authoritarian parenting style is still prevalent in China, resulting in far greater parental involvement in education compared to Western cultures (Thakkar, 2011). With this education culture at home and in the classroom discouraging individualism, technology-enhanced, student-centered learning experiences are a challenging goal. The education history of China is difficult to understand, and changes in traditional pedagogy cannot be achieved without a firm awareness of the influence of Chinese culture on the education system (Mingyuan, 2006). The wide-reaching impact of Chinese culture dramatically affects the education system's development as well as the beliefs and practices of educators in its sphere of influence today.

Exosystem: The Impact of Chinese Government Policies

The exosystem contains two key factors: (a) government reforms and policies as well as (b) infrastructure and resources. Together, these two dynamic elements have in the past and continue to indirectly influence the ability of educators in China to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets.

Government reforms and policies. In 1978, Deng Xiaoping implemented a series of economic reforms aimed at development and social mobility connected to economic growth that dramatically impacted education in China (Woronov, 2008). Despite China growing into the second economy largest in the world as a result of these reforms, these changes resulted in increasing inequality between the schools in less and more developed areas (Wan, 2012). Although the market economy expanded the education options, "it made these choices more a function of poverty, gender, and ethnicity" (Wan, 2012, p. 5). Education disparities resulted from China's adoption of an unequal economic investment approach (Xu & Law, 2015). This unbalanced focus left rural areas deficient of elementary education resources, making technology integration of little concern to educators and administrators. Additionally, two major government policy elements impacted the integration of technology within contemporary Chinese K-12 school environments: technology-driven and large population-related policies.

Several policies enacted since the 1980s resulted in technology integration within K-12 schools. MOE regulated all initiatives nationally. The first stage of development in information and communication technologies was a technology-dominated stage from 1986 to 2000 (Zhao & Xu, 2010), which was followed by a period when the integration of technology and education was more balanced from 2000 to the present. The first stage from 1986 to 2000 saw an influx of technology integration attempts for the first time in urban Chinese classrooms with the second stage employing a more planned, strategic approach (Zhao & Xu, 2010). These stages represented a paradigm shift within the Chinese school system toward technology integration and more student-centered instructional practices. Initial integration met with difficulties as well as frustration among educators. Teacher competency and existing inservice PD and preservice training programs did not meet the needs for integration, resulting in a backlash toward technology from teachers (Zhao & Xu, 2010). MOE initiated the second stage primarily to combat these issues, implementing PD, better development and integration of educational resources, and more thorough planning.

The period between 1996 and 2012 witnessed a significant initiative by MOE through a variety of integration plans. These included the Five-Year Development Program of School Computer Education (1996-2000), the 2003-2007 Action Plan for Invigorating Education (2004), the 2006-2020 National ICT Development Strategy (2006), and the China Educational Technology Plan 2011-2020 (2012) among others (Alamin, Shaoqing, & Le, 2015). Each of these reforms was a mandate for increased technology infrastructure in school settings. Of importance in 2000, the “Connecting Every School Project” (Liang et al., 2007) connected 90%

of primary and secondary schools to the Internet, launching a 5- to 10-year plan for access to high-quality resources for all educators and students (Jingtao, Yuanyuan, & Xiaoling, 2010; Zhou et al., 2011). Approximately one in 99 students had access to a computer as of 2000 (Liang et al., 2007). Although this number was lower than Western counterparts, it represented a leap forward for the Chinese education system (Liang et al., 2007).

Despite the number of initiatives, the results were unproductive (Alamin et al., 2015). Although MOE and its reforms encouraged PD programs in Chinese schools, only 10% of teachers assessed themselves as well-trained as the programs provided no specified guidelines for integration within instruction (Zhou et al., 2011). This need for compelling PD and guidelines for instruction impacted successful implementation by the policies developed by MOE. Also, without student-centered PD, teacher practices still interfered with effective integration (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhao & Xu, 2010).

Due to a need for PD as well as conflicts with pedagogical approaches, many Chinese teachers remain unprepared to use technology in the classroom to support 21st century skills (Liang et al., 2007; Sang et al., 2011; Zhang, 2007; Zhou et al., 2011). Coupled with limited budgets, a need for guidance from comprehensive national strategies, and unrealistic K-12 technology integration plans, China's educational development lags behind other Western countries (Liang et al., 2007). Although the Chinese education system is undergoing a paradigm shift more aligned with a holistic, constructivist perspective, it still wrestles with a rigid, traditional system that could take years to transition toward international best practices (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007). This aspect is related to the influence the exosystem exerts, indirectly affecting teachers through policy failures and poor financial investment.

Additionally, as a developing country with the world's second largest population, high student-teacher ratios further exasperate teachers' capacities to effectively integrate technology in instruction (Liang, Hou, & Chen, 2008). Large class sizes dominate the Chinese education landscape due to MOE policies, making student-led, technology-enhanced exploratory activities problematic (Wu et al., 2007). This class size issue, in association with philosophical perspectives on learning aligned with Confucianism, causes educators due to necessity as well as perception for teaching effectiveness to adopt pedagogical strategies that limit the use of student-centered pedagogical practices and rely on teacher-led lectures as the foundational approach to learning (Liang et al., 2008). Small class sizes potentially allow for the use of significantly more technology, and teachers may have better attitudes toward its implementation (Kurt & Ciftci, 2012). Although class size alone does not prevent technology integration, policies related to class ratios represent another barrier impacting successful technology adoption initiatives (Kurt & Ciftci, 2012).

Population dynamics also create a fiercely competitive environment in China with policies focused on constant assessment and testing pushing students to compete against peers to succeed. The Chinese education system's culture of high-stakes examinations also discourages educators from embracing more student-centered teaching approaches and integrating technology in instruction, instead encouraging them to teach directly to examination content. The examination requirements create further barriers to effective teaching (Wu et al., 2007). High teacher frustration results as crowded classrooms force them to employ teacher-centered teaching methods to address these testing requirements (Wu et al., 2007). Teachers could potentially integrate technology more effectively through an administrative decrease in student numbers per class and examination requirements (Kurt & Ciftci, 2012; Wu et al., 2007), but further research is required to investigate this impact.

Infrastructure and school resources. For this literature review, infrastructure and school resources refer to the school technology components (e.g., Internet, Wi-Fi) and the resources accessible to teaching staff (e.g., interactive whiteboards, tablets, computer lab). These elements fall under the exosystem as MOE and Regional Education Bureau guidelines directly impact the infrastructure and resources available to teaching staff. It also relates to the mesosystem due to its impact on teachers' access to school technology elements, which in turn influences their instructional practices.

China has invested less in education compared to many international counterparts, only using 2.9% of its GDP in 2005 versus the world average of 5% (Law, 2007). As a result, some schools charge mandatory fees, with higher socioeconomic class families able to pay for better schools (Law, 2007). Fee abuse and socioeconomic disparity in school selection in China "strengthen(s) the function of education as a reinforcer rather than an equalizer of social stratification" (Law, 2007, p. 194). When MOE attempted to end this corrupt system, Law (2007) asserted that it only managed to cut off schools' funding, forcing them to borrow money from banks, construction companies, and even teachers.

There was a reciprocal relationship between education investment and China's economy between 1952 and 2003 (Bo-nai & Xiong-xiang, 2006). Education investment contributed 24.4% to economic growth. This investment included human capital, physical resources, and financial resources to increase the availability of technology infrastructure and teacher resources. The recent decline in contribution from the government combined with the waste of learning resources through improper allocation and implementation, however, created severe issues in

China's education sector (Bo-nai & Xiong-xiang, 2006). Only urban centers and schools viewed as having the most future economic potential received funds to develop adequate infrastructure (Wenbin, 2012). Rural schools specifically struggled for financial support and necessary resources (Law, 2007; Liang et al., 2008). An article investigating legislation and educational change highlighted China's reliance on laws to bring about social justice in the education system but suggested consideration of economic, social, and cultural factors as well (Law, 2007). A qualitative study involving 7,878 rural elementary students indicated the need for special attention to improving the conditions of "left-behind children" (i.e., children of migrant worker parents), detailing few resources and detrimental environments (Liang et al., 2008, p. 84).

The disparities between resources in rural schools and their urban counterparts caused rural schools to struggle to provide basic supplies for students with technology out of their budgets (Yong, 2011). Reflecting on the modern education system in China, Yong (2011) identified four methods proposed by 20th century Chinese educators to reform the culturally complex society, suggesting the necessity for contemporary educational ideas and the need to address inequity in the education system. The economic reforms that launched China into the global economy came at the expense of its education system, particularly for those in disadvantaged and rural settings but extending to urban environments as well (Tan, 2010; Wan, 2012; Wenbin, 2012; Woronov, 2008; Xu & Law, 2015).

This evidence illustrates not only a discrepancy between rural and urban investment but in financial support to schools overall resulting in inadequate infrastructure and resources provided for teachers. Although not the focus of this study, this barrier highlights the universal nature of issues related to technology integration in Chinese educational contexts and a primary obstacle to technology integration in Chinese schools (Law, 2007; Liang et al., 2008; Wenbin, 2012). More importantly, it suggests a potential barrier that this project will not be able to impact and overcome but must remain vigilant of during the data collection process.

Mesosystem: The Impact of the School Environment

The mesosystem contains three significant factors: principal leadership, inservice PD and preservice training, and the parental perceptions of education in the home. Although it also relates to factors that lie within other levels of the ecosystem, the focus of discussion will remain on principal leadership and inservice PD and preservice training, as parental perceptions of education in the home was previously touched upon in the Chinese cultural influence section for cohesion of discussion purposes. Together, these three dynamic factors influence educators in school Chinese contexts directly and impact their capacities to support students to develop 21st century skills through technology-enhanced, student-centered learning experiences.

Principal leadership. Leadership involves one's ability to guide, motivate, and impact others to develop beyond the current level of performance (Bass, 1985, 1999). Principal leadership plays an essential role in technology integration in Chinese contexts (Chang, 2012; Li, 2006). As part of the mesosystem affecting teachers through direct, proximal processes, principal leadership plays a fundamental role, impacting social interactions and influencing teaching staff. Within the exosystem, principals take guidance directly from MOE and the Regional Education Bureau, and therefore, these governmental agencies exert indirect social influence through policy guidelines relative to teaching staff.

As leadership originates from the top down in schools, supportive leadership from the administration is critical to guide educators to integrate technology effectively in their classrooms as well as cultivate a culture of technology in the context (Chang, 2012; Machado & Chung, 2015; Kurland, Peretz, & Hertz-Lazarowitz, 2010). Administrators must understand their importance in creating the school technology culture and develop a long-term plan for integration that addresses the barriers a context will face (Chang, 2012; Kurland et al., 2010). Chang (2012) explored the complex relationship between principals' technological leadership, teachers' technology proficiency, and teachers' effectiveness. The study collected data from 1,000 teachers at Taiwanese elementary schools using multiple academic scales and structural equation modeling. It emphasized a detailed technology implementation plan from administration leaders coupled with supportive PD and infrastructure as vital to improving teacher effectiveness.

From principals' perspectives, teacher willingness and ineffective PD are two significant barriers to technology integration (Machado & Chung, 2015). A phenomenological study involving 42 principals from K-12 schools in California investigated principals perspectives related to technology integration and PD. Principals admitted a need for adequate PD and support as well as a desire for a deeper understanding of the importance that teacher education programs play in the school technology culture and planning (Machado & Chung, 2015). Similar to this research, an investigation of the importance of leadership and a principal's vision among 1,474 teachers at 104 elementary schools in Israel emphasized the essential nature of leadership to organizational learning (Kurland et al., 2010). If schools do not have the guidance of a long-term plan and a principal's vision, technology integration diminishes. Principals play an important role in cultivating an environment that promotes the use of technology by the teaching staff (Kurland et al., 2010; Machado & Chung, 2015).

Although a technology integration vision and leadership are crucial for schools, the technology literacy of school leaders is also essential to consider ensuring effective integration within a context (Dawson & Rakes, 2003; Li, 2006). Without high-quality PD programs for administrators, it is difficult for them to foster technology literacy knowledge in their staff and incorporate effective PD programs to train them for integration efforts in the classroom (Dawson & Rakes, 2003; Li, 2006). If teachers in a school do not share a vision of integration led by strong, well-trained principal leadership, it undermines consistency within the school environment (Wu et al., 2007). It also prevents sustainable change throughout classrooms in teaching and learning (Wu et al., 2007). Dawson and Rakes (2003) conducted a study in the United States, which involved 1,104 principals, and maintained principals' influence on technology integration and PD confirmed the importance of professional learning, describing it as a critical component for successful integration efforts.

Confirming the findings of Dawson and Rakes (2003), a 6-month, mixed methods study including 31 principals from Hong Kong kindergartens discovered most participants identified themselves as *technology learners*, novices with little technology experience and background in technology use and implementation. This identification highlighted an efficacy and PD issue of principal leadership (Li, 2006), emphasizing the need for an increase in experience related to technology use. A principal leadership perspective identified low teacher information and communication technology (ICT) proficiency, issues with hardware and software, a need for infrastructure support, and poor parental ICT competence as the primary problems, noting PD as essential to overcoming the technical challenges. This concept aligned with similar findings of Machado and Chung (2015) and Chang (2012), but the identification of low confidence and ability in administrative leadership contributed a new perspective to the root cause of these primary problems. With most identifying themselves as unable to be technology modelers or trainers, they needed to improve their knowledge and efficacy to lead teaching staff in technology integration efforts properly. Principals also experienced a transformation of beliefs to more positive attitudes regarding ICT, highlighting the importance of PD not only for teachers but academic leaders (Li, 2006).

Inservice professional development and preservice training. Inservice PD and preservice training programs help cultivate the skills necessary for a teacher to be successful with students in the classroom and positively impact instructional development (Garet, Porter, Desimone, Birman, & Yoon, 2001; Guskey, 2002; Lawless & Pellegrino, 2007; Loucks-Horsley, Styles, & Hewson, 1996). PD needs to improve comprehensive technology knowledge, confidence, and capacities among preservice educators in China (Cheung, 2008; Long et al., 2013; Pan & Franklin, 2011; Zhou et al., 2011). Existing programs do not address the needs and questions of K-12 teachers, and a lecture-based approach, which is the prevalent method of existing PD in China, is ineffective, presenting few opportunities for actual application by the participants (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007). Many teacher education documents used in China only refer to policy, not actual structured PD programs related to technology (Zhou et al., 2011). These guidelines offer the content and timing of instruction with students but often overlook how content should be delivered (Zhou et al., 2011).

Culturally sensitive PD is essential, especially when considering adapting Western technology-rich, student-centered education ideas for a Chinese context (Dai, Gerbino, & Daley, 2011). A mixed methods study of a new inquiry-based instructional reform with 582 middle and high school Chinese educators from 16 cities described practical constraints, such as high-stakes tests, content coverage, class size, PD, infrastructure, parents, and culture, as preventing proper technology implementation. The inquiry-based curriculum reform movement needs the support of parents, teachers, and administrators as well as strong administrative leadership reinforced by culturally sensitive PD to be successful (Dai et al., 2011). Considering the relationship between inquiry-based principles and student-centered technology integration, the parallels between the findings and technology implications are clear.

Additionally, educators need comprehensive training during university, providing practical knowledge and strategies and preparing preservice educators appropriately for the school environment (Zhan, 2008). Zhan's mixed methods study involving 490 Chinese K-12 educators aligned with findings of Dai et al. (2011) but emphasized the importance of preservice support before teachers even enter the classroom. The need for further teacher education prevents educators from transforming university classroom theory to actual classroom practice. Inservice PD and preservice training is a factor of fundamental importance related to the problem of practice as it impacts educators' capacities to integrate technology-enhanced, student-centered learning experiences effectively. As another crucial component of the mesosystem of the theoretical framework, it points to a severe obstacle facing teachers in Chinese classrooms.

Microsystems: Dynamic Influences within the Classroom

The microsystems, including teacher(s), classroom instructional practices, and student(s) contain a variety of interrelated factors that contribute to this problem of practice. The following section details each, highlighting the key elements including teacher epistemological beliefs, teacher knowledge, teacher pedagogical beliefs, teacher self-efficacy, instructional practices, student beliefs about technology as an instructional tool, student self-efficacy for learning using technology as a tool, and student perceptions of learning. These systems directly impact teachers through complex, overlapping proximal processes that influence teachers' abilities to provide technology-enhanced, student-centered learning experiences.

Teacher epistemological beliefs. Teacher epistemological beliefs describe teachers' beliefs regarding the nature of knowledge and knowledge acquisition (Kim, Kim, Lee, & Spector, 2013; Lee et al., 2013; Schommer, 1994). Epistemological beliefs can impact behavior, attitudes, pedagogical beliefs and practices, critical thinking, and overall learning achievement (Kim et al., 2013; Lee et al., 2013; Schommer, 1990). Teacher epistemological views, the perspectives at the foundation of how knowledge is transmitted and formed, have a significant impact on instructional practices, particularly those stemming from a strong cultural influence such as China. As noted previously regarding Chinese culture in the macrosystem, many Chinese teachers' epistemological views originate from Confucianism, a perspective of knowledge acquisition that is a consequence of an authoritative, lecture-based, behaviorist approach to education, which is when an expert provides knowledge to novice pupils (Lee et al., 2013; Li et al., 2012; Wang & Du, 2014). Behaviorism describes the learning process as a function of a change of behavior based on environmental factors (Schunk, 2012). In the case of a Chinese Confucianist approach, this is the expert imparting and helping knowledge form for students. This Confucian epistemological stance potentially hinders many Chinese teachers' capacities to provide technology-enhanced, student-centered learning experiences as many of their belief systems are fundamentally antithetical to these types of learning approaches, believing teachers should impart knowledge to students through disciplined, rote memorization learning strategies (Li et al., 2012; Sang et al., 2012; Zhan, 2008).

As discussed as part of the macrosystem, many Eastern cultures created education systems based on an expert-led model of Confucian philosophy throughout the 1900s, which fundamentally focuses on expert teachers providing knowledge to students (Zhang, 2007). This philosophical approach to education continues to impact Chinese teacher epistemological beliefs, extensively influencing Chinese society and teacher classroom practices (Zhang, 2007). Implementation problems exist with Western education models that are student-centered, such as the flipped classroom model. These problems occur because of education cultural discordance between the different contexts because of epistemological beliefs influenced by Confucianism with many Chinese teachers struggling to implement student-driven approaches due to conflicts with their beliefs on knowledge acquisition (Liu & Feng, 2015).

Liu and Feng (2015) investigated the cross-cultural implications related to pedagogical practice borrowing, focusing on a United States to China context transfer and evaluating the influence of epistemological and pedagogical viewpoints. The authors collected data from four school leaders and 32 Chinese middle school instructors implementing a United States' flipped classroom model. Many conflicts arose from traditional Chinese epistemological and pedagogical views that do not embrace the more innovative student-centered instructional approach. A culture's influential nature should be considered when borrowing educational practices (Li et al., 2012; Liu & Feng, 2015; Sang et al., 2012; Zhan, 2008). Additionally, adaptation strategies need consideration for diverse cultural contexts through effective PD (Liu & Feng, 2015). By analyzing flipped classroom integration using the themes of knowledge sources, knowledge transmission, and learning objectives, Liu and Feng emphasized the teacher dilemmas created due to the disagreements between Chinese epistemological and pedagogical practices with the more student-centered, constructivist views of the United States, highlighting an essential understanding necessary to conceptualize barriers to effective technology integration.

Confirming the findings of Liu and Feng (2015), an exploratory mixed methods study with 22 United States primary and middle school educators investigated the relationship between teacher beliefs' and pedagogical philosophies and integration of technology in instruction, highlighting the importance of addressing epistemological beliefs through PD to drive technology integration. Kim and colleagues (2013) maintained teachers' beliefs about the nature of knowledge and knowledge acquisition, learning, and effective instructional strategies directly influenced classroom technology integration and should be a primary consideration associated with effective school policy related to the implementation of technology. PD tailored to alter teachers' beliefs and attitudes about knowledge creation is essential to overcome obstacles to effective technology integration (Kim et al., 2013; Liu & Feng, 2015). The study provided a compelling example of how teachers' beliefs regarding teaching and knowledge fundamentally related to the usage of technology in classroom practices. Despite occurring in the United States, this study's conclusions correlate directly to a prevalent barrier to technology integration in Chinese schools related to teachers' perceptions, attitudes, beliefs, and understandings about teacher-led versus student-centered learning. This divide is demonstrated undoubtedly in the conflict between Eastern pedagogical philosophy and constructivist, student-centered epistemology. Though important limitations of the study included a small group of participants and the need for longitudinal perspective, the findings still align with other research regarding the Eastern and Western conflict of educational approaches (An & Reigeluth, 2014; Gu et al., 2013; Liu & Feng, 2015).

Teacher knowledge. Teacher knowledge refers to the whole body of knowledge, information, and insights an educator possesses and uses in daily classroom instruction (Rohaan, Taconis, & Jochems, 2012; Verloop, Van Driel, & Meijer, 2001). For this study, teacher knowledge refers to the understanding educators have regarding the use of educational technology within instruction (Figg & Jaipal, 2011; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Liu, Zhang, & Wang, 2015). Teacher knowledge is part of the microsystem. Educators' technology integration capacities influence their instructional practices with students and impact their self-efficacy for using technology-enhanced, student-centered learning experiences

(Cennamo, Ross, & Ertmer, 2010; Ertmer & Ottenbreit-Leftwich, 2010).

Technology knowledge and literacy regarding technology is an essential 21st century teaching skill in any school environment (Ertmer & Ottenbreit-Leftwich, 2010; Lawless & Pellegrino, 2007). The knowledge of how to use technology, however, does not equate to effective integration within instruction in the classroom (Ertmer & Ottenbreit-Leftwich, 2010). Meaningful student learning involves subject matter knowledge as well as pedagogical and technology implementation strategy awareness. Teachers need a knowledge skillset that allows them to pinpoint technology tools that support curricular goals and how students can use different technologies to meet these goals, helps them to cultivate appropriate student usage in the learning process, and identifies technology tools to address problems (Cennamo et al., 2010; Ertmer & Ottenbreit-Leftwich, 2010; Liu et al., 2015; Rohaan et al., 2012).

Although technology requires knowledge to benefit students (Ertmer & Ottenbreit-Leftwich, 2010), preservice and inservice educators often do not possess the technology, pedagogy, and content knowledge (TPACK) to incorporate it effectively (Liu et al., 2015). Koehler and Mishra (2005) initially employed the term technological pedagogical content knowledge (TPCK) to detail educators' knowledge about ICT integration. The term TPCK later evolved into technology, pedagogy, and content knowledge or TPACK (Liu et al., 2015). According to the TPACK framework, there are three main components of teacher knowledge related to technology integration: (a) content knowledge (CK), (b) pedagogical knowledge (PK), and (c) technology knowledge (TK) (Koehler, Mishra, & Cain, 2013). These three areas then overlap and interconnect in three additional knowledge areas: technological content knowledge (TCK), pedagogical content knowledge (PCK), and technological pedagogical knowledge (TPK) (Koehler et al., 2013). As highlighted by the Koehler and colleagues (2013), the "interaction of these bodies of knowledge, both theoretically and in practice, produces the types of flexible knowledge needed to successfully integrate technology use into teaching" (p. 13).

In a study of 2,728 Chinese K-12 educators' TPACK knowledge, young teachers were willing and able to use technology tools effectively but lagged behind senior educators regarding content knowledge (Liu et al., 2015). The experienced educators, although skilled in content knowledge and traditional methodology, resisted changing teaching methods to integrate modern technology and needed improved confidence in their TPACK. Inservice educators need to model specific uses of technology tools to increase their self-efficacy and therefore improve their positive perceptions of their pedagogical knowledge, technological knowledge, and content knowledge. Positive perception of one's TPACK has the most significant overall impact on the variable for educators (Liu et al., 2015), relating to ideas indicated by Cennamo and colleagues (2010) and Ertmer an Ottenbreit-Leftwich (2010) regarding necessary knowledge.

Whereas Liu et al. (2015) focused on the influence of positive perceptions on various areas of teacher knowledge, Rohaan and colleagues (2012) highlighted subject matter knowledge as a prerequisite for teachers' pedagogical content knowledge and self-efficacy related to technology integration. Similar to the findings of Liu et al. (2015), a quantitative analysis of 354 primary teachers from the Netherlands revealed only a basic level of subject matter knowledge as well as an insufficient level of pedagogical content knowledge regarding instructional technology integration. Although an element of primary level compulsory goals, educational technology is only infrequently used in Dutch schools due to a lack of "profound knowledge" despite positive attitudes and confidence toward technology (Rohaan et al., 2012, p. 279). The study highlighted the necessity for PD and more hands-on experience in the classroom related to technology integration (Figg & Jaipal, 2011; Rohaan et al., 2012).

Technology-enhanced instruction, however, provides meaningful learning when educators showcase powerful content knowledge and not just technical savvy (Figg & Jaipal, 2011). Content-centric approaches that involve teaching with technology promote student engagement and learning of both content and technical skills over pure technocentric strategies (Figg & Jaipal, 2011). This finding reinforces previous ideas indicated by Ertmer and Ottenbreit-Leftwich (2010) and Rohaan et al. (2012) that describe the critical importance of subject matter knowledge and its relationships to pedagogical and technology expertise. Two, 7-week Australian case studies asserted that content knowledge focused on lesson content and design enhanced meaningful student learning, noting TPACK-in-practice can lead to successful results involving enhanced student learning of content and technical skills (Figg & Jaipal, 2011). This concept is related to the ideas put forth by Mishra and Koehler (2006) and Liu and colleagues (2015), emphasizing the importance of the influence and interaction between content, pedagogy, and technology.

Similar to other teacher-centered variables, teacher knowledge is a critical construct to explore related to the microsystems as it directly impacts technology use. This primary factor highlights the need for an increase in teacher knowledge in all areas of TPACK for educators to offer technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets.

Teacher pedagogical beliefs. Teacher pedagogical beliefs refer to the perception or ideology that educators hold toward teaching and learning with teachers' belief systems helping them guide classroom instructional strategies (Kagan, 1992; Sang et al., 2011; Deng, Chai, Tsai, & Lee, 2014). Teachers' teaching and learning beliefs are part of the microsystem, affecting the implementation of educational strategies. Wu et al. (2007) and Zhang (2007) indicated that this construct impacts an educator's instructional practices in the classroom. This section details similar ideas of TPACK noted by Koehler and Mishra (2005) and Liu and colleagues (2015) in the previous section, focusing on teacher pedagogical content knowledge of technology integration and drawing a direct connection between teacher knowledge and pedagogical beliefs.

Preservice educators often enter instructor education programs with firmly established perceptions and ideas about instructional strategies to use with students (Ertmer, 2005; Kagan, 1992; Nespor, 1987; Sang et al., 2011). These approaches originate from the social and cultural exposure to pedagogical beliefs that the educators experienced in classrooms when they were learning in school. In general, teachers hold either traditional, behaviorist beliefs involving expert-centered classrooms or constructivist beliefs associated with pupil-centered, exploratory environments (Deng et al., 2014), but it is possible for educators to hold both perspectives. Educators who espouse traditional, teacher-led strategies regarding pedagogy maintain and continue to reinforce these ideas while working with students (Sang et al., 2011). Many Chinese people embrace the concept that lecture-driven instruction for examinations improves students' scores and chances of a better career (Law, 2007). These beliefs continue to cause resistance to more constructivist, student-centered environments in Chinese schools (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007).

Focusing on culture and social values with a survey methodology, Sang, Valcke, Tondeur, Zhu, and van Braak (2012) investigated the pedagogical beliefs of 727 Chinese primary student teachers from four different universities. These teachers' beliefs were examined as they related to four variables: gender, study year, major subject, and location. Authors employed the Teacher Beliefs Scale with ANOVA results highlighting significant differences in constructivist beliefs related to gender, subject, and year of study with no difference associated with traditional, lecture-based views. Findings maintained that cultural context played a fundamental role in the formation of teacher pedagogical beliefs, and constructivist ideas changed due to classroom realities. Transformation of the student teachers' pedagogical beliefs and practices regarding technology as an instructional tool between the first year and senior year at their respective universities from highly constructivist to more traditional resulted from classroom experience and obstacles as well as the need for effective PD.

Despite the integration of Western pedagogical ideas through education reforms, Chinese pedagogy based on historical, teacher-led Confucian philosophy still dominates classroom instruction today (Li et al., 2012). Li and colleagues (2012) involved 18 kindergarten teachers in Hong Kong, Shenzhen, and Singapore in a mixed methods study. The study highlighted ongoing cultural and sociological pitfalls to using any instructional methodology rooted in student-centered, constructivist philosophy in China due to pedagogical traditions, which is similar to the findings of Deng and colleagues (2014) and Sang and colleagues (2012). Traditional, social, cultural, and educational values of any society and the impact of language, teachers, parents, resources, and the local education system need consideration before making pedagogical adjustments, relating to earlier ideas highlighted regarding the need to understand culture when borrowing academic instructional practices (Li et al., 2012; Liu & Feng, 2015; Sang et al., 2012; Zhan, 2008). This idea is associated with the networked systems model proposed by Neal and Neal (2013), highlighting the integrated framework of overlapping constructs that impact both teachers and students either through direct or indirect proximal processes. This complexity of interactions described in both the model and the study need to be evaluated and understood before meaningful changes can be made to pedagogical approaches and strategies.

Similar to teacher epistemological beliefs, teacher pedagogical beliefs are deeply interwoven in the microsystems, deeply impacting instructional practices and strategies employed in Chinese classrooms. As highlighted by Sang et al. (2012), cultural and social contexts play an important role in the development and transformation of pedagogical beliefs for preservice educators. This core construct is of primary importance when investigating how to provide technology-enhanced, student-centered learning experiences as it impacts the instructional strategies educators will employ in the classroom.

Teacher self-efficacy. Self-efficacy refers to one's belief or perception, disregarding accuracy, in one's ability to succeed at a particular task or action (Bandura, 1982, 1997). The evaluation of one's self-efficacy on a given task can often influence one's behavior or actions (Bandura, 1982, 1994; Pajares, 2002). Teachers' self-efficacy for technology integration relates to teachers' confidence in their instructional abilities with students involving technology and how teacher education programs can develop these skills. Low teacher self-efficacy regarding technology use in instructional practices is another fundamental barrier affecting usage in classrooms (Cheung, 2008; Liang et al., 2007; Pan & Franklin, 2011; Zhou et al., 2011).

Student and parent opinions, preservice development, and ongoing teaching experience are some of the most influential factors impacting inservice teacher self-efficacy regarding ICT usage and integration (Cheung, 2008). Using a mixed methodology, Cheung (2008) compared the self-efficacy of 725 primary educators from 28 schools in Hong Kong and 575 teachers from 22 schools in Shanghai including contributing factors for teachers' self-efficacy perceptions. More teaching experience significantly raised self-efficacy, and researchers noted further exploration of teacher efficacy was necessary to improve Chinese educational practices.

Many preservice educators need more extensive PD in technology integration to be effective in the classroom and raise their confidence in using technological tools (Cheung, 2008; Zhou et al., 2011). An evaluation of the preparation to integrate technology into instruction among 390 Chinese secondary preservice educators identified low levels of confidence, proficiency, and limitations regarding technology implementation amongst the inservice educators. Participants, however, noted technology's importance in the classroom. Preservice educators need proper preparation to incorporate technology into instruction as well as more effective PD programs to improve self-efficacy (Zhou et al., 2011), which is similar to the conclusions of Cheung (2008). A joint study of American and Chinese teachers indicated similar low teacher self-perceptions of competencies (Liang et al., 2007). Most teachers described their competencies with educational technology as basic and unprepared and reported minimal technology integration. Liang and colleagues (2007) detailed a worse situation in China with the discrepancy stemming from a limited budget as well as the need for developed national strategies for technology integration in K-16 environments and PD programs.

Low teacher self-efficacy with technology also extends to the use of Web 2.0 tools, defined as online blogs, social networking sites, wikis, picture sharing sites, course management systems, and wikis, in classroom instruction (Pan & Franklin, 2011). A mixed methods study of 559 K-12 environments in 12 states investigated technology integration barriers and the relationship between teacher self-efficacy and factors predicting usage of Web 2.0 tools. Low levels of self-efficacy among participants regarding technology were prevalent, specifically related to Web 2.0 tools. To improve these levels, PD and administrative support need to foster teachers' self-efficacy. This notion is related to ideas put forth by Bandura (1982, 1997) and Pajares (2002), which highlight that one's self-efficacy on a given task influences one's behavior or actions and that focused practice can improve one's confidence. The prevalence of teacher efficacy issues in the U.S. suggests that technology self-efficacy issues are not exclusive to China and that educators in all contexts need proper PD and administrative support (Pan & Franklin, 2011).

Instructional practices. Instructional practices concern the actual educational strategies, approaches, and methods teachers employ in the classroom through different activities and exercises to promote student learning and achievement (Marzano, Pickering, & Pollock, 2001). As highlighted above within the discussion of Confucian philosophy, which forms a foundation for teaching practices in China, Chinese classrooms primarily use traditional, teacher-led instructional practices and do not incorporate student-centered technology activities (Spires et al., 2012; Li et al., 2012; Liang et al., 2007).

Chinese teachers typically engage students through teacher-led models of instruction based on the expert-led pedagogical ideas espoused by Confucianism (Li et al., 2012; Zhang, 2007). This approach to education limits students' abilities to engage in student-centered learning activities instead instructing them primarily through rote memorization and lecture-based instruction with drill practice. Many Chinese educators believe students should conform to the collective, listen to their expertise, and not express individualism by questioning their authority (Mingyuan, 2006; Rajaram, 2013; Thakkar, 2011), which is antithetical to student-centered practices.

Chinese educators' teacher-centered instructional practices have also regularly been influenced by performance-based economic reforms encouraged by MOE (Wang, Lai, & Lo, 2014). A qualitative study of 15 Shanghai administrators and educators noted teachers employed teaching strategies to meet external requirements such as the Gaokao, the national assessment test for university acceptance in China, rather than best instructional practices. This approach was a result of financial incentives. Economic incentives to schools and educators not only failed to improve teaching quality but resulted in a complete move away from instructional best practices in favor of an increased focus on high-stakes exam performance (Wang et al., 2014). Teachers embrace compliant professionalism, abandoning beliefs for school requirements tied to performance pay.

Additionally, many teachers employ technology for rudimentary tasks in instruction, including using PowerPoint presentations that involve rote memorization, simple typing exercises in a word processor, and other basic uses (An & Reigeluth, 2014; Becker, 1994; Brush & Saye, 2009; Ertmer, 2005; Russell, Bebell, O'Dwyer, & O'Connor, 2003). These approaches do not engage in student-led, exploratory activities fostering more in-depth construction of knowledge, but tend to permeate the extent of some teacher integration of technology (An & Reigeluth, 2014).

Constructivism involves more student-driven classroom instructional practices compared to traditional Chinese pedagogy related to current standards, instruction, and flexible grouping (Lee et al., 2013). A quantitative study of 1008 Chinese educators emphasized the significance teachers placed on the learning process with constructivism maintained by the majority of participants as their approach to instruction. The study represents an anomaly in the current research on this topic, noting more significant constructivist versus traditional instructional practices in Chinese junior secondary classrooms. Although other studies have indicated Chinese educators' high opinions of constructivism in the new curriculum reform movement (Li et al., 2012; Zhan, 2008), the majority describe traditional Confucian principles as the foundation for current classroom instruction (Li et al., 2012; Mingyuan, 2006; Rajaram, 2013; Thakkar, 2011; Zhang, 2007).

Low implementation of student-centered technology activities is not exclusively a Chinese education issue (Deng et al., 2014; Liang et al., 2007; Spires et al., 2012). Spires and colleagues investigated perspectives on technology and new literacies integration in the instruction of 291 teachers from Grades 5 to 9 in the United States and China. Both groups demonstrated low integration and usage in teaching. Despite cultural limitations in the comparison, educators in both environments reported needing more effective PD to improve self-efficacy regarding the use of innovative technologies and to foster frequent integration in instructional strategies (Spires et al., 2012). General agreement exists that technology provides enhancements to teaching and learning and improves aspirations to cultivate global citizens (Spires et al., 2012). Liang et al. (2007) previously verified these findings but claimed that educators from both contexts appraised their integration of technology in instruction as minimal, noting less effective integration in China.

Teachers' epistemic and pedagogical views within varied sociocultural environments influence the frequency with which technology is used in the classroom (Deng et al., 2014). Teacher' perceptions about knowledge, pedagogical philosophies, and instructional practices regarding technology integration correlate according to a quantitative study of 396 high school teachers. The authors maintained an alignment of Eastern and Western teachers' viewpoints and practices regarding technology integration practices as well as their epistemic and pedagogical views, advancing the idea that Eastern and Western educators may not be significantly different in their instructional practices. The similarities between these two groups of educators are critical to technology integration research as they suggest the ability for the analysis of similar research internationally, providing a broader spectrum of review regarding barriers to technology integration in instructional practices.

Considering this strong association, connections need to be increased among technology, pedagogy, and content to improve teachers' technology-enhanced instructional practices (An & Reigeluth, 2014; Deng et al., 2014). The authors employed a mixed methods design with 126 teachers from 27 contexts in rural United States districts. The study focused on the K-12 teachers' beliefs, practices, and challenges of creating technology-enhanced, learner-center classrooms (An & Reigeluth, 2014). Significant barriers to technology-related instruction included the need for improved infrastructure, increased instruction time, and proper assessment. PD focused on learner-centered instruction and environment customization, job learning experiences, and support for communities of best practice help educators develop. Without this critical infrastructure, technology integration efforts to augment instructional strategies encounter severe barriers.

As another primary construct of the classroom instructional practices microsystem, teacher instructional practices also form the foundation of student achievement and development of 21st century skillsets. As such, this is a crucial factor to examine for teachers to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets.

Student beliefs. Student beliefs in the present study refer to three different components: student beliefs about technology as an instructional tool, student self-efficacy for learning using technology as a tool, and student perceptions of learning. Student beliefs about technology as an instructional tool refer to the views that students hold toward teaching and learning through technology-enhanced learning experiences and how they impact their understanding. Student self-efficacy relates to students' judgments in their abilities to successfully execute a particular task or action (Bandura, 1986; Linnenbrink & Pintrich, 2003) and how it will impact their behavior (Bandura, 1982, 1994; Pajares, 2002). In the present study, student self-efficacy refers specifically to self-efficacy for learning using technology as a tool. Student perceptions of learning relate to how and under what conditions students believe effective learning occurs.

Student beliefs about technology as an instructional tool. A complex relationship exists between technology usage of faculty and students with actual technology integration in classroom activities as one of the determining elements if students support its use (Gu et al., 2013). A mixed methods study of a stratified random sample of 2,161 students and 249 teachers from Shanghai K-12 schools determined both students' and teachers' beliefs play a key role in ICT usage in the classroom. Gu and colleagues (2013) selected four reoccurring factors within outside research associated with technology acceptance barriers to frame their study, including beliefs, goal expectancy, environment/social influence, and appropriateness. Students reported higher technology integration expectations than teachers and therefore were more receptive to technology integration than their teachers. Students also described more use of technology at home than at school. This discrepancy suggested teacher beliefs and practices as the potential root cause and primary barrier to technology integration, requiring further longitudinal investigation. It also highlighted the significant influence of students' opinions regarding technology integration in their classrooms. The study's findings relate to other research in China (Chen, 2008; Li et al., 2012; Sang et al., 2012; Zhan, 2008), highlighting how teachers' traditional behaviorist beliefs conflict with student-centered technology integration and suggesting a divide between teacher practices and student desires.

Students generally view technology favorably, believing it increases efficiency, provides diverse approaches to learning, prepares them for the future, and increases motivation and confidence (Gu et al., 2013; Li, 2007). A mixed methods study of 15 mathematics and science faculty and 450 students from four Canadian secondary schools also described a dissonance between students' and teachers' views, focusing on their perceptions regarding technology (Li, 2007). Although teachers recognized students' approval of technology, they held negative attitudes toward technology integration, feeling it should only be applied when necessary and expressing fear regarding being replaced by computers. Students, on the other hand, "cry out loud for more frequent use of technology and the adoption of more current technology in schools" (Li, 2007, p. 391). The distinct divergence of opinions between teachers and students is essential to review further as it creates a fundamental discord that will negatively impact any effort to push forward further technology integration in schools. Successful integration efforts involve an acknowledgment of all stakeholder views, including administrators, teachers, and students, with results from the study suggesting teachers often ignore their students' beliefs and desires.

Students' favorable view of technology integration extends to technology-enhanced instruction, such as Wiki-based Collaborative Process Writing Pedagogy (WCPWP), feeling it raises motivation and improves the collaborative engagement process (Li, Chu, Ki, & Woo, 2012). University of Hong Kong researchers worked with 59 primary Chinese students and described that WCPWPs could improve student writing in a constructivist, collaborative environment with benefits noted from student and teacher perspectives. This study demonstrates the beneficial integration and effectiveness of modern technology within a current instructional practice in a Chinese primary classroom and also highlights students' positive beliefs about technology-enhanced learning. From participating in a constructivist social format, students and the teacher noted benefits from engagement with the WCPWP, which broadened their understandings regarding technology usage and transformed beliefs regarding potential pedagogical approaches to learning. A more meaningful understanding by educators of the relationship between education, pedagogy, and technology and how it can positively impact and change student perceptions is needed (Li et al., 2012).

In contrast, an investigation of the use of a tablet computer in K-12 schools in China with 114 students, 47 teachers, and 68 administrators from developed areas revealed little use among all participants and the need for extensive instructional planning within the curriculum for tablet computers (Long et al., 2013). The majority of participants, particularly students, needed a foundational understanding of how the devices improved teaching and learning, which impacted their willingness to use them. This study draws a compelling parallel between the effective integration of innovative technologies and the attitudes of students, teachers, and administrators regarding their effectiveness. Integration of new technology calls for the support of systematic planning regarding teacher PD, instructional strategies for application, proper infrastructure, and awareness of the positive benefits as the attitudes of students, teachers, and administrators have a fundamental impact its success (Long et al., 2013). Without these components in place, effective integration will encounter multiple barriers. The acceptance of innovative technology in a school ecosystem involves the support of various stakeholders, of whom students are essential members.

Student self-efficacy for learning using technology as a tool. As stated above, in the present study, student self-efficacy refers to self-efficacy related to learning using technology as a tool. Self-efficacy is vital to raise student motivation and promote student engagement and learning (Linnenbrink & Pintrich, 2003). Self-efficacy promotes behavioral, cognitive, and motivational engagement that leads to successful learning and achievement (Linnenbrink & Pintrich, 2003). Behavioral engagement refers to actions that students visibly display and relates to effort, persistence, and instrumental help-seeking on tasks as well as willingness to persist (Bandura, 1997; Linnenbrink & Pintrich, 2003; Schunk, 1989, 1991). Cognitive engagement refers to students' strategy use and metacognition with the quality of effort related to self-efficacy (Linnenbrink & Pintrich, 2003; Pintrich & Schrauben, 1992). Motivational engagement refers to students' interest, value, and affect placed on learning in a given situation with self-efficacy acting as a motivational construct (Linnenbrink & Pintrich, 2003; Pintrich & Schunk, 1996).

Teachers can assist students in raising and maintaining their self-efficacy by offering difficult tasks that will challenge students to persevere to achieve them and cultivating the idea that effort can improve one's abilities and success at accomplishing a given task through the promotion of task-specific self-efficacy (Linnenbrink & Pintrich, 2003). This fostering of self-efficacy is important as it impacts how students will view their capacities to learn and achieve 21st century skills in the classroom through technology-enhanced activities with the task-specific self-efficacy focused on appropriate technology use and application. Students with high self-efficacy will be more engaged and therefore more likely to be successful in classroom activities (Linnenbrink & Pintrich, 2003) with repeated engagement in technology-focused activities enhancing this self-efficacy even further. Positive and statistically significant relationships exist between academic performance, persistence, and student self-efficacy beliefs "across a wide variety of subjects, experimental designs, and assessment methods" (Multon, Brown, & Lent, 1991, p. 30). This same relationship exists between the learner and technology self-efficacy, and therefore, it is crucial for teachers to encourage students to develop this area through frequent engagement.

Student self-efficacy impacts academic motivation, learning, and achievement (Pajares, 1996; Schunk, 1995; Schunk & Pajares, 2002). Students perceptions of their self-efficacy also affect task choice, effort, persistence, and resilience in activities, which leads to achievement (Schunk, 1995; Schunk & Pajares, 2002) with higher self-efficacy typically resulting in improved success rates (Schunk & Pajares, 2002). Student self-efficacy develops from a variety of factors, including familial influence in the home, peer influence, school support, and periods of transition in schooling (Schunk & Pajares, 2002). Teachers must consider how to positively impact and grow students' self-efficacy when integrating technology to enhance classroom activities as well as support their development of 21st century skills. Low teacher attention toward student progress is a primary factor in the decline self-efficacy suffers as students advance through school (Schunk & Pajares, 2002).

Students self-perceptions, including self-efficacy, of technology usage are often higher than those of their teachers (Gu et al., 2013). As described previously in the student beliefs about technology as an instructional tool section, Gu and colleagues (2013) investigated the difference between students and teachers regarding technology acceptance in the classroom, focusing particularly on personal factors, including computer self-efficacy and personal innovativeness with technology. Although important for both parties, students possessed significantly higher self-perceptions regarding technology compared to teachers, relating to the typical description of digital students (i.e., those able to access more technology at home than at school) (Gu et al., 2013). More research is needed on the topic, but understanding young learners' perceptions of technology associated with their self-efficacy can help identify areas of instructional improvement for educators in the classroom as well as areas of future practice to explore (Gu et al., 2013).

Examining these ideas together suggests that teachers must build a foundation of successful support, which demonstrates to students their abilities to enhance their 21st century skills through technology integration and then continue to reinforce upon this initial core efficacy through verbal persuasion and additional experiences. Using behavior, motivation, and cognitive engagement, educators can cultivate self-efficacy in students (Linnenbrink & Pintrich, 2003) through experiences that foster a sense of accomplishment and therefore increase the influence on academic motivation, learning, and achievement (Pajares, 1996; Schunk, 1995; Schunk & Pajares, 2002), all of which relates to student perceptions of learning.

Student perceptions of learning. Chinese students' beliefs about learning have a solid foundation in traditional Chinese culture, shaping their perceptions on effective learning approaches (Chan & Rao, 2009). Ideas such as diligence, self-perfection (i.e., the idea of a perfect, diligent student in Chinese society), and persistence in learning relate directly to this traditional cultural approach among young Chinese learners with their development influenced by family, the community, teachers, and other factors (Chan & Rao, 2009; Wang, 2013). The learning behaviors of Chinese students are flexible and able to adapt to different classroom learning pressures with a notable example occurring in Hong Kong classrooms where students embraced Western instructional strategies and reforms (Chan & Rao, 2009; Wang, 2013). However, research has yet to identify clearly why Chinese students are adaptable to fluid learning environments or how it influences their learning (Wang, 2013). Despite this limitation, student-centered Western curriculum and traditional education ideas can be integrated to positively impact Chinese students' perceptions of learning and student outcomes (Wang, 2013).

According to Western and Eastern studies, successful students often hold stronger constructivist beliefs regarding learning strategies than low achievers, who tend to embrace more traditional memorization strategies (Chan & Sachs, 2001; Law, Chan, & Sachs, 2008). A quantitative data investigation of learning beliefs of 417 grade five and 420 grade six students from six Hong Kong schools highlighted the positive effect students' constructivist beliefs had on text comprehension as well as other learning areas (Law et al., 2008). High achievers also reported higher levels of self-regulation. More effective achievement occurred among Chinese primary students who avoided traditional pedagogical approaches of rote memorization and reproduction of knowledge, detailing a discrepancy between achievement and actual teacher-led instruction in China. Law and colleagues (2008) not only detail that constructivist pedagogical practices are better for student learning, but implications suggest that technology-enhanced, student-centered learning experiences would improve teacher effectiveness. Further research is needed to analyze this assumption.

Student beliefs regarding technology, self-efficacy, and perceptions about learning are vital components to examine as students are the primary beneficiaries of any positive effects from technology integration to enhance instruction and the development of 21st century skills. As a primary stakeholder, students represent a fundamental component that can influence the successful use of technology-enhanced, student-centered learning experiences in the classroom to foster the development of 21st century skillsets. Without student support through their various belief systems, integration efforts in any classroom or school are guaranteed to suffer significant setbacks.

Summary

The research literature, organized explicitly through the theoretical framework of an EST model, offers several implications regarding the problem of practice. Multiple factors interact with one another in a complex system, including the integration of technology to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets. The fundamental underlying issues identified were Chinese culture and society (Li et al., 2012; Mingyuan, 2006), historical government reforms and policies (Wan, 2012; Woronov, 2008), infrastructure and resources (Tan, 2010; Wan, 2012; Wenbin, 2012), principal leadership (Chang, 2012; Li, 2006; Machado & Chung, 2015), inservice PD and preservice training (Dai et al., 2011; Long et al., 2013), teacher epistemological beliefs (Kim et al., 2013; Lee et al., 2013), teacher knowledge (Ertmer & Ottenbreit-Leftwich, 2010; Figg & Jaipal, 2011; Mishra & Koehler, 2006), teacher pedagogical beliefs (Ertmer, 2005; Sang et al., 2011; Wu et al., 2007), teacher self-efficacy (Cheung, 2008; Pan & Franklin, 2011; Zhou et al., 2011), instructional practices (Li et al., 2012; Spires et al., 2012), student beliefs about technology as an instructional tool (Gu et al., 2013; Li, 2007), student self-efficacy for learning using technology as a tool (Linnenbrink & Pintrich, 2003; Pintrich & Schunk, 1996), and student perceptions of learning (Chan & Rao, 2009; Wang, 2013). Figure 1.2 displays the conceptual model of investigation for this study related to a Chinese and BPS context, noting how each of the factors causally influences the other with student beliefs grouped in one construct. Student beliefs about technology as an instructional tool, student self-efficacy for learning using technology as a tool, and student perceptions of learning are combined within student beliefs.

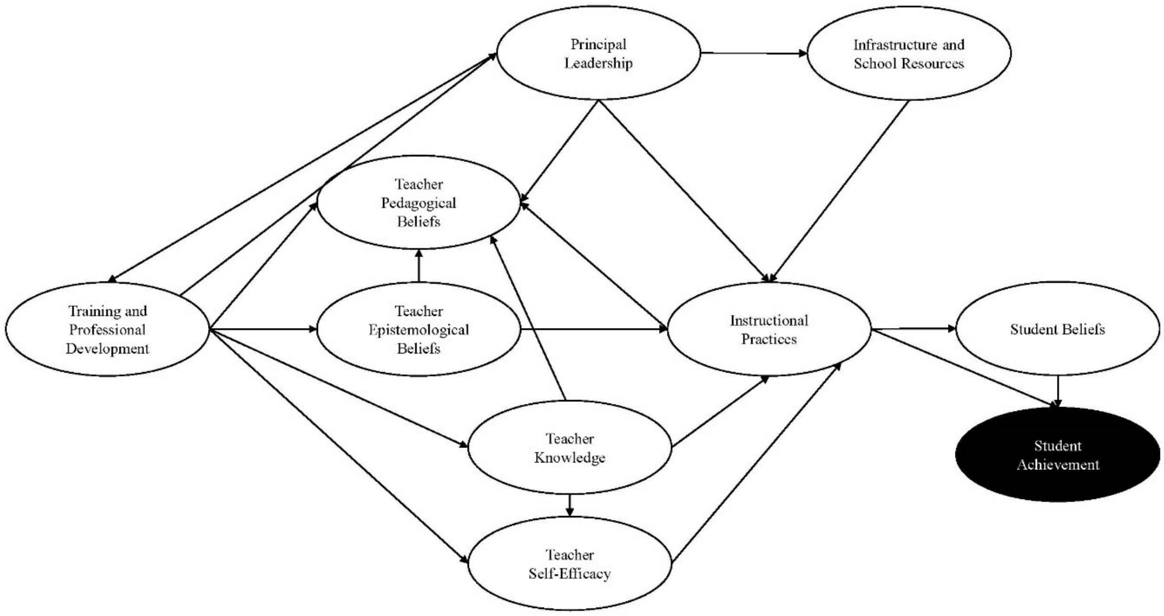


Figure 1.2. Conceptual Model

Few studies in a Chinese context have explored these factors from a systems or networked perspective, highlighting a complete picture of intertwined influences impacting each variable. Research in China and throughout the world emphasizes similar issues encountered by educators. Figure 1.2 highlights the causal links between the numerous factors, leading from the foundation of PD, which in turn influences teacher beliefs, knowledge, and skills, and finally leads toward student achievement. Focusing on teachers as a primary element of change to impact student achievement, literature highlighted PD as a fundamental change catalyst to positively improve multiple teacher factors, including teacher epistemological beliefs (Kim et al., 2013; Lee et al., 2013; Liu & Feng, 2015), teacher knowledge (Figg & Jaipal, 2011; Rohaan et al., 2012), teacher pedagogical knowledge (Li et al., 2012; Sang et al., 2011), teacher self-efficacy (Spires et al., 2013), and instructional practices (An & Reigeluth, 2014; Deng et al., 2014; Lee et al., 2013). This relationship aligns with the conceptual model in Figure 1.2.

Research needs to investigate the interconnected relationships and influences of the various factors within China, specifically at a school where a team of local and international educators employs international and regional curricula.

The structure of the needs assessment study offers initial measurements of infrastructure and resources, principal leadership, PD, teacher epistemological beliefs, teacher pedagogical beliefs, teacher self-efficacy, and instructional practices to identify obstacles preventing teachers from implementing technology effectively. The assessment also investigates potential discrepancies between locally and internationally trained staff regarding a range of factors related to technology usage. Each of these primary variables is then systematically examined to determine the influence of the elements.

I selected these critical factors as they were identified through the literature as essential components to understand and investigate regarding the integration of technology-enhanced, student-centered learning experiences to support the development of students' 21st century skills. As an educational professional focused on teacher development to improve student achievement, these factors emerged as foundational factors to examine in BPS to provide instrumental information in the construction of a supportive intervention.

Chapter Two

Assessing the Educational Technology Needs of Primary Teachers at BPS

The integration of technology to improve technology-enhanced, student-centered learning experiences that support the development of 21st century skillsets is a function of multiple factors that interact in a complex, networked ecological manner. The fundamental underlying issues explored in the needs assessment study include infrastructure and resources (Bo-nai & Xiong-xiang, 2006; Wenbin, 2012), principal leadership (Chang, 2012; Machado & Chung, 2015), the need for enhanced PD related to student-centered strategies and educational technology (Ely, 1999; Hew & Brush, 2007), teacher epistemological beliefs (Zhang, 2007), teacher pedagogical beliefs (Sang et al., 2011; Zhou et al., 2011), teacher self-efficacy (Cheung, 2008; Li et al., 2012; Long et al., 2013), and instructional practices (Li et al., 2012; Wang et al., 2014).

I employed a mixed methods study to explore principal leadership and PD as underlying factors influencing technology use within the BPS school context. Additionally, the study examined teachers' beliefs related to the use of educational technology in instructional practices and the obstacles preventing them from implementing it efficiently in their instruction. The study also focused on potential discrepancies between local and international staff regarding numerous factors related to the integration of technology. A mixed methods design allowed for the triangulation of quantitative and qualitative data as well as a comprehensive overview of the underlying factors affecting technology incorporation within this context. The interviews provided depth to support understanding of the findings from the survey. The design of the needs assessment study intended to provide answers to the following research questions:

RQ1: What are the teachers' perceptions of the school's current technology-related PD, infrastructure, and school resources for teachers and students?

RQ1a: How do locally and internationally trained teachers' perceptions of the school's current technology-related PD, infrastructure, and school resources for teachers and students differ?

RQ2: What are teachers' beliefs (epistemological, pedagogical, and self-efficacy) regarding the integration of technology into instructional practices to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets?

RQ2a: How do locally and internationally trained teachers' beliefs regarding the integration of technology differ?

RQ3: What are teachers' present self-reported instructional practices?

RQ4: What are the principal's perceptions of her ability to support teachers to integrate technology, her technology integration vision, and her school planning regarding technology integration to promote students' development of 21st century skillsets?

The goal of this chapter is to detail the study's context, method, participants, instruments, participant identification and selection, data collection, data analysis, and initial findings.

Context of Study

The problem of practice describes the need for teachers' effective incorporation of technology into their instructional practices to improve technology-enhanced, student-centered learning experiences and support development of 21st century skillsets. BPS was a private K-6 international school located in Beijing, China and was established in 2012. It closed in 2017.

BPS accepted international and local passport holders and had 105 students with a maximum enrollment of 500 based on available class spaces at the time of the needs assessment study. Class sizes averaged around 12 students with a maximum capacity of 22. There were 10 international and 12 Chinese teachers. BPS was a bilingual school with a focus on English and Mandarin, requiring teachers to be recruited both locally and abroad from native English-speaking countries as noted in the participant section. The curriculum included 70% International Primary Curriculum (IPC) and 30% Chinese national-based curricula focused on Chinese and mathematics. There was no documentation to state why the curriculum was split in this manner, though the principal suggested it was to align with local Beijing Education Bureau standards. The school's mission was to build:

> China's leading international-bilingual K-12 school through programs that empower students with solid bases of knowledge and the skills to achieve future success in a global environment. We pride ourselves on providing supportive school atmospheres that facilitate effective learning and emphasize creativity, leadership, and personal integrity. (CONTEXT, 2017, p. 2)

Although infrastructure and resources appeared as part of the exosystem in the literature review, these factors were included as part of RQ1 as BPS was a private school that controls its finances, which is not the case for other Chinese schools that rely on government support.

Method

I collected quantitative and qualitative data simultaneously using a survey and two interview protocols to triangulate the findings. The survey provided data for statistical analyses relative to the research questions, and the interviews with teaching staff and the principal added insight and more in-depth understanding and highlighted specific areas of need and focus. The needs assessment data analysis plan table in Appendix A describes each research question and the related construct, definition, measurement tool, and data analysis. As BPS includes local Chinese and native English speaking international teachers, I provided the survey in both English and Mandarin to ensure that participants all could understand items in their native language.

Participants

I invited all teaching staff of the primary school of BPS to participate. The participants included 16 of 22 Chinese and international teachers working in K-6 classrooms within BPS. Table 2.1 describes the summative participant demographics with a full table reported in Appendix B.

Table 2.1

Summative Participant Demographic Information

Code	All Participating Teachers Mean (*SD*)	Chinese Teachers Mean (*SD*)	International Teachers Mean (*SD*)
Age	30.38 (*5.26*)	30.50 (*5.60*)	30.17 (*5.15*)
Years of Teaching Experience	6.78 (*3.64*)	7.40 (*4.15*)	5.75 (*2.60*)
Years of Technology Experience	5.50 (*3.76*)	5.70 (*4.17*)	5.17 (*3.31*)
Gender	f = 14 m = 2	f = 10	f = 4 m = 2

Participants' ages ranged was from 22 to 55 with 14 of the 16 teachers (87.50%) between 25 and 35 years of age and the principal being the oldest participant. The mean teacher participant age was approximately 30.38 years of age with a range from 22 to 43 years of age. The study included fourteen female teachers (87.50%) and two male teachers (12.50%). The teachers had between one half and 13 years of experience with only five participants (31.25%) having 10 or more years of teaching experience. The principal also possessed more than 10 years of teaching experience. The mean years of teaching experience was 6.78 years, which represents a cohort of teachers relatively new to the profession. The mean years of technology experience was slightly lower at 5.50 years, also highlighting a group of teachers new to technology use in the classroom. For 11 of the 16 participants, the years of teaching experiences equaled the years of technology experience with the five additional teachers having less experience with technology. Five teachers were Caucasian (31.25%), one teacher was Black (6.25%), and ten teachers were Asian (62.50%), originating from China. The principal was a Caucasian female. The teachers all graduated with at least a bachelor's degree in education focused on either early childhood, primary, secondary, or general teaching, representing 71.43% of the academic team. Approximately 28.57% hold master's degrees with the international staff being officially certified to teach in their various countries of origin. All Chinese staff held certification to teach in China. International teachers originated from one of seven native English-speaking countries approved by the Beijing Education Bureau for visa processing, including Australia, Canada, England, Ireland, New Zealand, South Africa, and the United States. Of those who participated, two were Canadian, two were American, one was Irish, and one was English, representing 37.50% of the sample, with the principal originating from Australia.

The teachers represented the full spectrum of primary school grade levels from kindergarten to sixth grade with two teaching kindergarten (12.50%), two teaching first grade (12.50%), three teaching second grade (18.75%), four teaching third grade (25.00%), one teaching fourth grade (6.25%), one teaching fifth grade (6.25%), and three teaching multiple grades (18.75%). The teachers taught a wide variety of subjects with international teachers focusing on all core subjects in line with the IPC (37.50%) with most Chinese staff focusing on Chinese language and mathematics (31.25%). Two Chinese staff members reported only teaching Chinese (12.50%), two reported teaching multiple subjects (12.50%), and one reported teaching music (6.25%).

Instruments

Three instruments were used in the needs assessment study to investigate the problem of practice, including an interview protocol for teachers, a teacher survey, and an interview protocol for the principal. The instruments are in Appendices C, D, and E, respectively. To ensure the accuracy of the translation, I employed a translation and back-translation procedure, using two fluent bilingual research assistants who were full-time research and development officers in my research and development department, both with master’s degrees and multiple years of experience in the education field. First, one of the research assistants translated the original English version into Chinese. Next, the second research assistant translated the Chinese version back into English without viewing the original English version. I then compared this new English version with the original English version with the two research assistants for alignment and accuracy. As no issues arose, I combined the English and Chinese versions into a bilingual format and provided this version to all participants.

Teacher interview protocol. The Teacher Interview Protocol was created to offer deeper understanding of the opinions and attitudes of the teaching staff of BPS regarding the inservice PD and preservice training, instructional practices, and self-efficacy factors related to educational technology accommodation. The 12-question protocol consisted of three sections, including inservice PD and preservice training, instructional practices, and self-efficacy (see Appendix C). Two subsections, self-efficacy and inservice PD and preservice training, included a majority of researcher-constructed interview questions, and the instructional practices subsection included questions from Kim et al. (2013). An expert panel, including the director of the Johns Hopkins doctoral program, confirmed face validity of the items.

Sample questions in the self-efficacy section included, “Do you feel comfortable with implementing technology-based instruction within your classroom? Why or why not?” and “Do you feel the school support you have received has improved your confidence using technology within instructional practices? Why or why not?” Sample questions in the inservice PD and preservice training section included, “Can you describe your preservice professional development experience regarding technology integration into instruction?” and “What are your current needs regarding professional development connected to technology implementation?” Finally, sample instructional practices questions included, “What technologies do you believe are most effective to improve student knowledge in instructional practices? Why?” and “Have you felt the need to alter your instructional practices to integrate technology?”

Teacher survey. The purpose of this survey was to gain insight into the BPS teachers’ beliefs and attitudes related to the inclusion of educational technology in instruction. The 73-item survey consisted of five subscales, including perceptions of PD, epistemological beliefs, pedagogical beliefs, self-efficacy, and demographic questions (see Appendix D). A majority of items were adapted from several context-relevant studies noted in detail below by section. An expert panel, including the director of the Johns Hopkins doctoral program, confirmed face validity of the items.

Perceptions of professional development. The perceptions of PD scale explored how teacher education programs help cultivate the skills necessary for a teacher to be successful with students in the classroom and was modified from a previous survey (An & Reigeluth, 2014). The PD section of the survey contained questions focusing on PD programs in the school context and their perceived effectiveness. I altered the wording of one item, changing “I am satisfied with my current professional development programs and activities” to “The current professional development programs and activities meet my satisfaction." Responses were measured on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree).* The original scale and study reported no reliability estimates. Sample questions included, "They help me understand how teaching and learning change when particular technologies are used" and "They provide some technology integration ideas, but they are too general to be applied easily to my classroom."

Teacher epistemological beliefs. The teacher epistemological beliefs scale measures teachers' beliefs regarding the nature of knowledge and knowledge acquisition (Kim et al., 2013; Lee et al., 2013; Schommer, 1994). The survey also adapted the epistemological beliefs section from Lee et al. (2013), using 16 of the 18 original items with some wording changes. For example, the original scale had the item, "If one tries hard enough, then one will understand the course material." This study modified the statement to read, "If one tries hard enough, then one will understand what is being taught in class." I deleted two questions from the innate/fixed ability subscale due to repetition. The original deleted statements included, "There is not much you can do to make yourself smarter as your ability is fixed at birth" and "Some children are born incapable of learning well in certain subjects." I felt these were redundant considering the scale already had the statements, "Our abilities to learn are fixed at birth" and "The ability to learn is innate/inborn." This section contained items in four subscales: innate/fixed ability (6 items), learning effort/process (3 items), criticizing authority (3 items), and certainty knowledge (4 items). Both versions measured responses on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree).* Sample questions constituted, "Our abilities to learn are fixed at birth" and "If one tries hard enough, then one will understand what is being taught in class." Reliability of the original scale was estimated by the researchers for each subscale: innate/fixed ability (α = 0.93), learning effort/process (α = 0.79), criticizing authority (α = 0.81), and certainty knowledge (α = 0.81) (Lee et al., 2013).

Teacher pedagogical beliefs. The teacher pedagogical beliefs scale measures perceptions that teachers hold toward teaching and learning (Kagan, 1992; Sang et al., 2011; Deng et al., 2014). I modified a scale from Lee et al. (2013) for the pedagogical beliefs section, using all 26 original items with some wording changes for four questions. For example, the original scale included the question, "In good classrooms, there is a democratic and free atmosphere that stimulates students to think and interact." This study used the same question except removed the word "good." Another revised question in the original scale was, "Good teaching occurs when there is mostly teacher talk in the classroom." This study modified the question to, "Good teaching occurs when the teacher leads the discussion, and the students listen with little interaction." This section contained statements ranging from a traditional, lecture-based perspective to a student-centered, exploratory perspective. The instructional strategies were measured by 26 items. Student-centered methods were measured by 12 items, and traditional strategies were measured by 14 items, which were reverse coded for data analysis. Participants responded on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Sample questions included, "It is important that a teacher understands the feelings of the students" and "Learning occurs primarily from drilling and practice." Reliability of the original scale was measured for both the constructivist items *(*α = 0.96*)* and traditional items *(*α = 0.95*)*.

Teacher self-efficacy. The teacher self-efficacy scale measures one's belief in or perception of one's ability to succeed at a particular task or action (Bandura, 1982; 1997). The 24-item Teachers' Sense of Self-Efficacy Scale by Tschannen-Moran and Woolfolk (2001) was heavily modified for the present study to reflect the focus on educational technology.

The self-efficacy section contained 21 questions reflecting teachers' confidence using technology in instruction, adjusting wording from the original scale to make items technology specific. For example, the original scale used questions such as, "How much can you do to help your students think critically?" and "How much can you do to help your students value learning?" In this study, the modified questions appeared as, "How much can you use technology to help your students think critically?" and "How much can you do to help students value learning through the use of technology?" Another example of a wording change altered the original item, "How much can you do to improve the understanding of a student who is failing?" to "How much can you do to improve the understanding of students regarding a particular subject using technology?" The present study combined several questions, including "How well can you respond to defiant students?", "How well can you keep a few problem students form ruining an entire lesson?", "How much can you do to calm a student who is disruptive or noisy?", "How much can you do to get children to follow classroom rules?", "How much can you do to control disruptive behavior in the classroom?", and "How much can you do to get through to the most difficult students?", into the new question, "How well can you manage student behavior during activities with technology?" to avoid redundancy. Additionally, the original scale items, "How well can you establish a classroom management system with each group of students?" and "How much can you do to adjust your lessons to the proper level for individual students?" were adapted and combined into the item, "How much can you establish technology within individual and group student work?" Finally, original items, "How well can you respond to difficult questions from your students?" and "To what extent can you craft good questions for your students?" were combined into the new item, "How much can you help students utilize technology to improve their learning and school work?"

I also deleted one item as it did not align with the study's research questions and lacked relevance: "How much can you assist families in helping their children do well in school?" Three new items that were added to this scale included, "How much can you utilize technology within your instruction in the classroom?", "How much can you use technology in general?", and "List the three major factors that contribute to your confidence with technology use within instructional practices."

The original measure rated responses on a 9-point Likert scale ranging from 1 (*None at all*) to 9 (*A Great Deal).* To make all subsections align with a mostly uniform response scale, I altered this subscale to a 5-point Likert scale ranging from 1 (*None at all*) to 5 (*A Great Deal).* Considering these significant modifications, the reliability of the original scale does not apply. Sample questions included, "How much can you utilize technology within your instruction in the classroom?" and "How much can you help students utilize technology to improve their learning and school work?"

Principal interview protocol. The 13-question Principal Interview Protocol consisted of two sections: vision and technology plan (see Appendix E). I employed several interview questions from a previous study for this interview protocol (Machado & Chung, 2015). The vision section of the interview protocol consisted of 10 questions. Sample questions included, "What do you see as the purpose of technology in the classroom?" and "How do you view the importance of technology integration for student achievement and construction of knowledge? What about for learning 21st century skills?" The technology plan section of the principal interview protocol consisted of three questions. Two sample questions were, "Can you describe your current technology plan for your school?" and "What is the teaching staff's biggest concern regarding the current technology plan for the school?"

Procedure

The following sections outline participant identification and selection, data collection, and data analysis for the needs assessment study.

Participant Recruitment

K-6 teaching staff at BPS were recruited to participate in the study by direct invitation during a meeting as well as through follow-up conversations by the principal. I invited all 22 teaching staff, but six teachers opted out of participating in the survey. I randomly selected six of the 16 primary teachers for in-depth, follow-up interviews by randomly selecting participant numbers. None of the six selected interviewees opted out of participation. Participants were only referred to by the number assigned to them on the survey, and the identities of the sample population were only known to the research assistant and me. In addition, the principal was interviewed. The Needs Assessment Consent Protocol is in Appendix F.

Data Collection

During April 2017, I provided a paper copy of the 73-item Teacher Survey to the 16 teaching staff participants. I offered instructions to the participants, asked them not to discuss the survey with each other, and allowed them several days to return it. I conducted all follow-up interviews in a private meeting room at BPS to ensure confidentiality and candor of responses. Interviews were scheduled during the participant's planning time during school hours to avoid any interruptions. I audiorecorded the interviews for comprehensive analysis. Two Chinese research assistants conducted interviews with the Chinese staff in Chinese.

The interviews invited the participants to discuss their views thoroughly and were open-ended to offer them the opportunity to expand upon their answers. To ensure a comprehensive response to each question, I encouraged participants to elaborate upon their opinions regarding educational technology incorporation by asking open-ended, follow-up questions. I explained this procedure before the interviews began, noting the goal of the process was to elaborate upon their initial survey answers. Each interview ranged in length from thirty to sixty minutes.

Data Analysis

The data analysis section is described below. First, it provides an overview of the analysis process for quantitative and qualitative data. Then it discusses the specific data analysis of measures in order of research question.

Quantitative data analysis. First, items that reflected traditional pedagogical beliefs were reverse coded to ensure that all items reflected more student-centered pedagogical attitudes with increasing value. Second, Cronbach's alpha estimates were calculated for each subscale, which are reported in the findings section. Third, descriptive statistics, including mean and standard deviation (*SD*), were computed for each participant for each of the five subsections of the survey using Microsoft Excel (see Table 2.2). Finally, means for Chinese and international teachers were compared using a Mann-Whitney U test.

Qualitative data analysis. Next, I had the interviews transcribed to English verbatim back. Additionally, I checked for accuracy using a translation and back-translation procedure, in which notes translated to English by one assistant were translated back to Chinese by the other for verification of accuracy compared to the original. I used a thematic analysis approach to analyze the interview data. This hybrid approach included both inductive and deductive coding as detailed by Fereday and Muir-Cochrane (2006). The following a priori categories emerged from the literature and are the focus of this analysis: (a) inservice PD and preservice training, (b) infrastructure and resources, (c) teacher epistemological beliefs, (d) teacher pedagogical beliefs, (e) teacher self-efficacy, (f) instructional practices, and (g) principal leadership.

First, I identified a priori themes after conducting a thorough literature review. These codes were then listed in a codebook and searched for within the transcribed interviews. After identifying a priori themes, I then noted additional emergent subcodes to add to the code system based on multiple reviews of participants' interview responses. I then went through the interview transcripts another time to look for statements that fit within this broader coding scheme. I coded each of the interview transcripts with attention to emerging themes. The analysis involved constant comparison to combine similar concepts into overarching ones. Finally, I triangulated codes with the full process repeated for a comprehensive review. I reviewed each of the participant interviews a total of five times.

Once the quantitative and qualitative data were analyzed separately, I then analyzed the data together, searching for areas of triangulation of significant themes and trends. This comparison highlighted areas for review in the findings and discussion section. The following sections highlight specific data analysis related to each measure.

Findings and Discussion

This section is organized to align with the four research questions. For RQ1, RQ2, and RQ3, I triangulated the survey and teacher protocol data, describing areas of alignment that support assertions related to the research questions and comparing areas in which the data diverged to triangulate findings. For RQ4, I reported the principal interview responses, highlighting key findings discovered through the thematic coding process and related the results to themes associated with RQ1, RQ2, and RQ3.

Reliability Estimates

I calculated reliability estimates for each scale and subscale for the 16 participants using Cronbach's alpha to assess internal consistency. The acceptable lower end for Cronbach's alpha on a scale is 0.70 (Cortina, 1993). The PD scale had acceptable reliability ($\alpha = 0.94$), noting strong alignment of items and internal consistency. The subscales of the epistemological beliefs scale had the following reliability estimates: innate/fixed (α = 0.85), learning effort/process (α = 0.50), criticizing authority (α = 0.69), and certain knowledge (α = 0.83). Although the reliability was acceptable and average or slightly above average for most subscales, the reliability of the learning effort/process subscale is questionable. The pedagogical beliefs scale had acceptable reliability (α = 0.70) with moderate, but not strong internal consistency. The self-efficacy scale had strong reliability and internal consistency (α = 0.96).

Teacher Perspective: Professional Development, Infrastructure, and School Resources

To respond to the first research question relative to the teachers' perceptions of the current school technology PD, infrastructure, and school resources available for teaching staff and students, teachers' responses on the survey were analyzed descriptively and their interview responses were analyzed using thematic coding. Survey results, as well as interview responses, were compared to highlight similarities and differences between international and locally-trained staff responses throughout this section to address the first research subquestion. Table 2.2 provides the means and SDs from the Teacher Survey. For reference, a full list of survey items, means, *SD* values, and agreement levels are presented in Appendices G, H, I, and J for the four primary constructs: perceptions of PD, epistemological beliefs, pedagogical beliefs, and self-efficacy.

Table 2.2

Summative Findings Table

Scale	All Teachers *M* (*SD*)	Chinese Teachers *M* (*SD*)	International Teachers *M* (*SD*)	*p*
Perceptions of PD	3.07 (1.00)	3.41 (0.99)	2.50 (0.77)	0.049

Epistemological beliefs: innate/fixed ability	1.97 (0.60)	2.20 (0.55)	1.58 (0.49)	0.049
Epistemological beliefs: learning effort/process	3.29 (0.64)	3.33 (0.63)	3.22 (0.70)	0.70
Epistemological beliefs: criticizing authority	3.63 (0.57)	3.70 (0.60)	3.50 (0.55)	0.44
Epistemological beliefs: certain knowledge	2.25 (0.67)	2.15 (0.77)	2.42 (0.47)	0.45
Pedagogical beliefs	4.04 (0.25)	3.93 (0.21)	4.21 (0.23)	0.025
Self-efficacy	3.37 (0.65)	3.50 (0.61)	3.15 (0.72)	0.63

The perceptions of PD mean ratings (M = 3.07 on a 5-point scale, SD = 1.00) reflected a neutral response from the participants regarding their experiences related to past and present PD (see Appendix G). Although this subsection of the survey maintained the highest average standard deviation (SD = 1.00), responses did not suggest either a positive or negative perception amongst participants, requiring further comparison with individual items and qualitative data on this factor.

A fair amount of support, however, existed for PD in the context. The most participant agreement occurred on the item that PD programs help to improve pedagogical knowledge as well as their understanding of how teaching and learning can change when technologies are used with 56.25% of participants (n = 9) agreeing. Additionally, 50.00% (n = 8) agreed that PD helps create a technology-enhanced, learner-centered program. Finally, 50.00% (n = 8) agreed that PD helps to improve their content knowledge. These statements represented the most substantial areas of agreement, showcasing participants viewed PD as providing beneficial skills and knowledge to teachers. Teachers also felt that PD that was technology-focused offered more than just information on how to use technology. The most disagreement occurred with the statement PD programs focus primarily on how to operate technology with 43.75% of participants (n = 7) disagreeing and 43.75% (n = 7) remaining neutral.

To determine whether there was a difference in perceptions of PD between ten Chinese (M = 3.41, SD = 0.99) and six international teachers (M = 2.50, SD = 0.77), the overall perceptions of PD were compared (Table 2.2). A Mann-Whitney U test revealed a statistically significant difference between mean rating responses of Chinese and international teachers (U = 12, Z = -1.965, p = 0.049). The Chinese teachers reported a more positive view of the PD provided in the school than the international teachers, potentially reflecting their desire to provide a socially acceptable response. Interview data corroborated this finding but noted a poor view overall of staff toward the current PD situation in the context. These data, combined with the findings in the self-efficacy interview data noted later in the self-efficacy findings, indicated a need for adequate school support. One participant wrote an unsolicited handwritten comment on the survey, noting, “If I had received PD in ICT areas, I would strongly agree that it would benefit my teaching.”

Themes that emerged from the interviews included a need for school support regarding technology as well as primary insufficiencies in infrastructure and hardware. All the interview participants (100%) noted that inaccessible Wi-Fi, as well as broken hardware, prevented effective integration into instruction, highlighting a barrier in the context. The participants described a need for school support in each interview, noting no technology staff and full-time IT support were available. This supported findings relative to self-efficacy revealed through an examination of self-efficacy data with participants highlighting their low technology self-efficacy directly resulted from a multitude of factors, including a lack of PD and training, administrative support, infrastructure, and principal leadership. This finding suggests from a teacher perspective that their low confidence levels with technology usage are a result of broader school issues. The triangulation of data highlights the relationship between these factors in this context. This school-wide area of improvement calls for more in-depth analysis to understand the comprehensive scope of the infrastructure issues faced by the school context. Participant responses, however, suggest a serious area of concern regarding infrastructure and resource support in the setting and a desire to receive additional school support to integrate and use technology in their classrooms effectively. These data reflect and align with similar themes in the literature (Kurt & Ciftci, 2012; Tan, 2010; Wan, 2012; Wenbin, 2012) associated with poor technology infrastructure and support structures in contexts acting as a primary barrier for teachers wanting to use technology with their students.

Another major theme within the interviews was a need for PD. Participants reported that BPS's current PD does not meet their needs regarding using technology with one international participant explaining, "It does not exist." A second participant described the amount of PD as, "Zero." Finally, a third Chinese participant noted, "No, [*sic*] almost doesn't exist." This participant then added, "What they provide is not systematic. The school hasn't invited outside experts to deliver this kind of training. Just asked some teachers to share their experience." According to participants, this need for PD not only existed for school technology implementation in instruction but all academic areas, pointing to a system-wide problem with the school's teacher development structures. Regarding current needs for PD in the school, one participant responded, "I would settle to just having my Smart Board fixed," which was later described as having been broken for over a year at the time these data were collected. The results highlighted a gap in professional learning for teaching staff within the context, preventing them from being able to gain the knowledge and skills necessary to use technology effectively with their students. This finding also aligned with research literature (Dai et al., 2011; Long et al., 2013; Wu et al., 2007; Zhang, 2007) maintaining that PD was a necessity of educators related to technology use and absent in many contexts, leading to teacher frustration and issues with technology integration.

Although some interviewees described preservice training experiences as well as prior work experience, Chinese participants overall noted a lack of preservice training and experiences with technology, noting issues of self-efficacy regarding technology, which is highlighted further in the self-efficacy findings below. One Chinese participant explained, “We don’t have it (preservice training). We learn and share with others (teachers).” Not only had they received no university training related to how to integrate technology effectively, BPS provided no support as well associated with their IPC curriculum, which relies heavily on technology-related resources. This finding aligned with the survey data, which reflected a similar absence of professional learning and need for PD. Each interviewee noted a lack of inservice PD since joining the current school context, lowering their confidence with new technologies. The Chinese interviewees, along with the principal, also highlighted that the school Chinese and mathematics programs did not use any technology. Once again aligning with the research literature (Cheung, 2008; Long et al., 2013; Pan & Franklin, 2011; Zhou et al., 2011), the absence of preservice training for participants reveals yet another gap in the university education process of educators related to technology, leaving them unprepared when they first enter the classroom to use technology.

Findings highlighted a critical gap in the teacher education programs in the school related to any subject, but particularly technology. Additionally, the participants’ responses to the final open-ended question aligned with the major themes that emerged from the interviews with PD;

updated infrastructure, hardware, and software; practice and experience; and general school support repeatedly requested by participants. The teacher interviewees revealed a high percentage of technology-infused components of their lesson plans were unusable due to the need for a VPN (i.e., a very private network) and the ability to access resources due to China's firewall. Inadequate Wi-Fi further limited usage. Considering the daily school curriculum involves this type of access, many teachers found it ineffective and were forced to adapt through alternative methods and extra preparation. Indicators in both the quantitative and qualitative data argued that BPS needed to take significant measures for the successful implementation of technology in its classrooms. There was no disagreement on this by any of the participants, including the principal. Despite being a privately funded international context, the situation described at BPS aligned with that of poorly funded Chinese public schools reviewed in the literature, potentially pointing to a somewhat universal issue in school settings in China regarding attention to infrastructure, school support, resources, and PD needs of educators related to technology use.

Teacher Perspective: Teacher Beliefs

To respond to the second research question regarding teachers' beliefs (e.g., epistemological, pedagogical, and self-efficacy) about the integration of technology, teachers' responses on the survey were analyzed descriptively, and their interview responses were analyzed using thematic coding. To address the subquestion related to potential differences between international and locally-trained staff responses, survey results, as well as interview responses, were compared to analyze similarities and differences between the two groups throughout this section. Additionally, a Mann-Whitney U test was conducted to examine if there was a significant difference between the two groups.

The epistemological beliefs mean ratings varied across the four subscales. The innate/fixed ability subscale (*M* = 1.97, *SD* = 0.60) had the lowest average mean, suggesting an overall slight trend among participants toward the belief that intelligence is due to environmental interactions. The next lowest mean was the certain knowledge subscale (*M* = 2.25, *SD* = 0.67), which supports the interpretation that participants believed knowledge was fluid and can be impacted by students' environments as well as effective instructional strategies in the classroom. Both the learning effort/process (*M* = 3.29, *SD* = 0.64) and criticizing authority (*M* = 3.63, *SD* = 0.57) subscales had slightly higher than average means. This finding revealed that participants did not have a strong opinion on the impact of effort on the learning process. It also suggested participants did not view students' criticizing authority either positively or negative in terms of influencing their learning. All subscales had low standard deviations between scores.

The teacher's responses on epistemological beliefs subscale items (see Appendix H) suggested that teachers' beliefs about pedagogy were in slight opposition to Confucian pedagogy and more traditional viewpoints on knowledge development. The mean of participants' responses on statements that reflect innate/fixed ability (*M* = 1.97) fell below 2 (see Table 2.2), suggesting participants supported ideas that knowledge was flexible and malleable through dedication and challenging work. A large majority of participants (*n* = 13, 81.25%) disagreed that abilities to learn are fixed at birth, that the ability to learn is innate/inborn, and that one's innate ability limits what one can do. Additionally, a majority of participants (*n* = 15, 93.75%) disagreed that students who begin school with 'average' ability remain 'average' throughout school. Finally, 100% of participants (*n* = 16) disagreed that scientific knowledge is certain and does not change. These responses highlighted a pattern among the Chinese and international staff of disagreement with traditional, Confucian ideas that knowledge is fixed at birth and expert instilled. This idea was also supported through the responses that generated high agreement, including getting ahead takes a lot of work (*n* = 13, 81.25%), sometimes I do not believe the facts in textbooks written by authorities (*n* = 8, 50.00%), even advice from experts should often by questioned (*n* = 12, 75.00%), and I often wonder how much experts really know (*n* = 9, 56.25%). The majority of participants epistemological beliefs did not reflect the research literature (Lee et al., 2013; Li et al., 2012; Wang & Du, 2014), instead suggesting a more international understanding of how knowledge is cultivated in students, moving away from some of the cultural ideas of knowledge related to Confucianism.

To determine whether there was a statistical difference in epistemological beliefs scores between ten Chinese and six international teachers, the mean epistemological beliefs subscale scores were compared (Table 2.2). A Mann-Whitney U test revealed a statistically significant difference between mean rating responses of Chinese (M = 2.20, SD = 0.55) and international teachers (M = 1.58, SD = 0.49) on the innate/fixed ability subscale (U = 12, Z = -1.971, p = 0.049) with Chinese teachers reporting a stronger belief in innate/fixed ability than international teachers. The participant interview data did not corroborate this finding. Chinese participants did generally note students' abilities to grow and improve their abilities through effective learning strategies, countering the idea of innate ability. One participant said, "I think students remember and learn best when they can feel, relate, and internalize what they are learning. So, in class, if you [*sic*] just lecturing them, they will remember very little. They remember and learn things that they can relate to." A Mann-Whitney U test revealed no statistically significant difference between mean rating responses of Chinese (M(learning effort/process) = 3.33, SD = 0.63; M(criticizing authority) = 3.70, SD = 0.60; M(certain knowledge) = 2.15, SD = 0.77) and international teachers (M(learning effort/process) = 3.22, SD = 0.70; M(criticizing authority) =

3.50, *SD* = 0.55; *M*(certain knowledge) = 2.42, *SD* = 0.47) on the learning effort/process subscale (*U* = 26.5, *Z* = -0.384, *p* = 0.70), the criticizing authority subscale (*U* = 23, *Z* = -0.773, *p* = 0.44), and certain knowledge subscale (*U* = 23, Z = -0.764, *p* = 0.45). The lack of significant difference on these latter three scales between the Chinese and international participants was somewhat surprising, reflecting a different understanding than the research literature and highlighting a more open-minded view of Chinese participants regarding the learning process.

The pedagogical beliefs mean ratings (*M* = 4.04, *SD* = 0.25) had the highest value of any subscale and reflected strong support from the majority of participants regarding student-centered pedagogical beliefs compared to traditional teacher-led approaches. As the average standard deviation (*SD* = 0.25) was also low, this suggested an agreement between local and international teachers related to their pedagogical beliefs. This finding was also surprising as it once again maintained Chinese participants held pedagogical views differing from the Confucian viewpoints noted in the literature (Law, 2007; Sang et al., 2011) instead leaning more toward student-centered learning approaches.

A few interesting findings emerged in an initial review of the participants' pedagogical beliefs ratings (see Appendix I). Participants responded with no disagreement on several items, indicating strong support for student-centered pedagogical approaches. One hundred percent of participants (*n* = 16) agreed that it is important that a teacher understands the feelings of students and that good teachers always encourage students to think for themselves. Additionally, 100% (*n* = 16) agreed that instruction should be flexible enough to accommodate individual differences among students. A majority of participants (*n* = 15, 93.75%) agreed that effective teaching encourages more discussion and hands-on activities for students.

Participant responses that generated high disagreement also demonstrated support for student-centered pedagogical approaches based upon constructivist theory in the classroom. A majority of participants (n = 15, 93.75%) disagreed that teaching is simply telling, presenting, or explaining the subject matter and that good teaching occurs when the teacher leads the discussion and the students listen with little interaction. One hundred percent (n = 16) disagreed that the only purpose of teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it and that a teacher's task is to correct students' misconceptions right away instead of allowing the students to verify them for themselves. The participants demonstrated strong support for student-centered over teacher-centered teaching and learning, which is a move away from Eastern Confucian philosophy and behaviorist ideology. It is unknown why precisely these findings were counter to expectations based on the research literature.

To determine whether there was a statistical difference in pedagogical beliefs scores between ten Chinese (M = 3.93, SD = 0.21) and six international teachers (M = 4.21, SD = 0.23), the mean pedagogical beliefs scores were compared (Table 2.2). A Mann-Whitney U test revealed a significant difference (U = 9.5, p = 0.025) between mean rating responses of Chinese and international teachers. This difference highlighted that the international participants maintained more student-centered pedagogical views than Chinese participants. Pedagogical views noted in each interview expressed a desire for more technology-enhanced, student-centered activities within instruction versus teacher-led lectures. One Chinese participant noted, "It is absolutely important to students. It is a supplement to learning. It makes learning more dimensional, dynamic, and more extensive." International teachers, however, were more likely to support student-driven, constructivist learning pedagogical approaches than Chinese teachers.

Interview data supported this finding with one Chinese participant noting that student-centered, technology-driven activities were unnecessary to help teach Chinese and mathematics. The principal and other teachers corroborated this finding, suggesting that Chinese pedagogical approaches in Chinese and mathematics did not support student-centered learning strategies and relied more upon an expert-led model of teaching. These findings are important as they highlight a discrepancy between Chinese participant survey responses favoring student-centered pedagogical practices and actual practice. Based on the observations of the principal and other teachers, there is the strong potential that Chinese participants were providing what they viewed as socially acceptable responses, a common cultural occurrence in China to avoid offense or disagreement (Zhang, 2007). Without actual class observations on participants to align responses with practice, it is not possible to exactly highlight a reason for this discrepancy. The validity of the Chinese participant survey data, however, must be held in question as a result of this difference.

The self-efficacy mean ratings ($M = 3.37$, $SD = 0.65$) reflected a neutral response from the majority of participants regarding their self-efficacy related to technology use and implementation. As this subsection of the survey maintained a low standard deviation as well ($SD = 0.65$), responses did not suggest either a high or low level of self-efficacy related to technology amongst participants, requiring further comparison with individual items and qualitative data on this factor.

Participants' responses on the self-efficacy items suggested many of the teachers rated their self-efficacy with using technology in instruction as average (see Appendix J). Participants responses on each item were minimally neutral from 25% of the participants with some responding with a much higher neutral response rating. A majority of participants ($n = 13$, 81.25%) replied with a neutral response to the question, “How much can you help students value learning through instruction with technology?” Seventy-five percent (n = 12) responded neutral to the question, “How much can you do to foster student creativity using technology?” Additionally, 62.50% (n = 10) responded neutral to the questions: (a) “How much can you help students utilize technology to improve their learning and school work?” (b) “How much can you use a variety of technology integration strategies within your instruction?” (c) “How much can you do to improve the understanding of students regarding a particular subject using technology?” and (d) “How well can you utilize technology within activities to provide appropriate challenges for very capable students?” Participants only responded to one question with high agreement (n = 9, 68.75%), “How well can you manage student behavior during activities with technology?” With this strong average response regarding the self-efficacy questions related to technology integration, additional room for growth in self-confidence and competency emerged as a contextual need. This finding aligned with research literature (Cheung, 2008; Pan & Franklin, 2011; Zhou et al., 2011), which reflected technology self-efficacy as a fundamental area of need for most educators. The neutral self-efficacy response is also not surprising considering the results of the previous section, highlighting poor infrastructure and school support as well as an absence of PD related to technology.

The outliers in these areas tended to be international staff who felt they were competent in the use of technology for basic student interaction. These data need further triangulation with interview data to understand this finding. In the final open-response, self-efficacy question asking participants to list the three major factors contributing to their confidence with technology use in instruction, the most repetitive responses included PD; updated infrastructure, hardware, and software; practice and experience; and general school support. This finding suggested the importance of PD to teachers' self-efficacy related to technology use in instruction. It also highlighted that even with PD and training teachers require practical experience using technology resources in a supportive school environment to maintain and expand this confidence with technology integration.

The interview data detailed teacher beliefs, specifically self-efficacy, and highlighted low teacher technology self-efficacy in both international and local staff. For example, one participant noted, "I think my confidence has fallen over the last couple of years." Another Chinese participant detailed low teacher efficacy regarding their capacities for using technology, noting, "Teachers are not proficient in using multimedia. What we have is confined to very simple skills." Participants believed that school support improved teacher confidence using technology in instruction. However, an international participant explained, "It's just the support we were given is not sufficient." Another international teacher was more direct, responding, "I will keep this short and sweet. It is a no. Why not? Because no one has make those [*sic*] available to us." This highly negative response from participants regarding self-efficacy did not align with the quantitative survey data, which reported a more neutral response to teacher technology self-efficacy items. This lack of corroboration through the interview responses described a much lower teacher technology self-efficacy level in the context. Although all teacher interviewees stressed the importance of technology to support the development of 21st century skillsets, they described a lack of use within the BPS context and a need for support to improve self-efficacy regarding technology integration into instructional practices highlighted further in the next two sections. These results associated with low technology self-efficacy align more with the research literature (Cheung, 2008; Pan & Franklin, 2011; Zhou et al., 2011) than the neutral responses on the survey, pointing to an area of growth necessary in BPS for teachers to effectively integrate technology in their classrooms.

To determine whether there was a statistical difference in teacher self-efficacy scores between ten Chinese ($M = 3.50$, $SD = 0.61$) and six international teachers ($M = 3.15$, $SD = 0.72$), participants' mean self-efficacy ratings were compared (Table 2.2). A Mann-Whitney U test revealed no significant difference ($U = 25.5$, $Z = -0.489$, $p = 0.63$) between self-efficacy ratings of Chinese and international teachers. This finding was surprising as interview data suggested a higher efficacy level for international staff than Chinese teachers but still a low efficacy level for both. This finding suggests that Chinese teachers may have overestimated their self-efficacy and once again highlights a social desirability issue that potentially relates to Chinese culture and collectivism highlighted in the literature review (Zhang, 2007).

Teacher Perspective: Instructional Practices

To respond to the third research question relative to teachers' self-reported instructional practices, teachers' responses to the interviews were analyzed using thematic coding. All the interviewees noted that they used to feel comfortable integrating technology in their instructional practices, but that confidence had fallen in the current BPS context due to hardware issues. One participant noted, "I have a Smart Board in my room, and I barely use it. Because the few times I went to use it, it has been glitchy and messing up." Poor infrastructure, hardware issues, and other technology issues also made it necessary for teachers to alter instructional practices to integrate technology in the context. One international teacher noted, "This is China, so yes, mostly because it will always fail you. So, you basically have to have a perfect plan for if the technology works, and the more likely plan where it won't work." This comment highlighted how, instead of enhancing instruction in the context, technology integration was more of an additional concern for teaching staff rather than assisting to improve instruction.

Considering the issues related to poor infrastructure in the context as well as broken equipment, weak WiFi, and the need for a VPN, the interviewees noted wanting to use technology but remaining hesitant to do so due to bad experiences. One respondent highlighted learning her lesson to avoid technology in instruction at a public event, explaining, "I was playing a video online for the event, but it got stuck due to the internet. It was so embarrassing." Each detailed the need to employ workarounds to use the large number of technology resources related to the school-wide IPC curriculum, either downloading resources at home or asking for support from other teaching staff as a VPN was required. One teacher explained, "They've been talking about getting a VPN since the day I started in 2014, so at least three years now." These poor experiences lowered the motivation of teachers in the context to use technology and therefore use more reliable, traditional approaches.

Even those who employed multimedia, particularly Chinese staff, only used technology integration in their classrooms in the most basic manners. One Chinese participant explained, "In our school PPTs, computers, and screens are most [*sic*] used. Because we (Chinese teachers) teach Chinese and math, we don't need to use too [*sic*] advanced technology." This statement highlights a viewpoint, at least with this participant, that technology cannot be used to enhance Chinese language and mathematics learning. The Chinese participants, as well as the principal, described the Chinese and mathematics programs used by BPS as void of any technology elements. Participants also expressed the need for more school support related to technology integration. One Chinese participant noted that, "The school only provides the equipment like projector and computers." A similar sentiment shared by the other participants, it highlights a gap in context support for teachers to integrate technology in their instructional practices. The lack of technology integration in participants' instructional practices is not surprising considering the infrastructure and school support challenges they faced. These findings also align with previous responses associated with RQ1 and RQ2, highlighting a connection of the impact of infrastructure and school support challenges, lack of PD, and belief and technology self-efficacy issues on technology integration practices in the classroom.

Principal Leadership

To answer the fourth research question relative to the principal's self-efficacy, vision, and school planning related to technology integration, the principal's responses to the interview were analyzed using thematic coding. The principal noted early in the discussion, "For the 21st century, it is important that we use technology and a variety of different technologies." Even though this importance was stressed at the beginning of the interview, the principal detailed a less than ideal environment currently at BPS.

The principal corroborated teacher data, detailing the need for funds, staff, time, and infrastructure. Each of these factors was highlighted as a barrier to technology integration in BPS. The principal explained, "There is [*sic*] not a lot of technologies or different technologies within the school." She highlighted outdated technology as well as the need for technological tools in many classrooms as obstacles. Additionally, she noted staffing issues hinder integration; "We don't really have support staff to be able to do that. We don't have the expertise either of varied staff members." She continued to explain that Chinese staff needed PD to effectively use technology, asserting, "They haven't had the opportunities to develop at school. Plus, they don't use it in their programs." The principal's comments, particularly about Chinese staff, relate to the inconsistency in statements versus practice of some Chinese participants regarding pedagogical beliefs. Her remarks also reflect an agreement with the teachers on the current barriers to technology integration facing BPS.

Supporting data from the teachers, the principal contended PD as a critical gap in the school regarding technology integration. The principal identified the entire teaching staff as needing more focused PD specifically focused on technology. For example, she noted, “They need to know about different technologies and how they work. So they can select which particular technology is going to enhance how they teach.” Although the principal highlighted PD as a gap in teacher knowledge, no further information was provided on plans by the administration to address this issue. This absence of initiative reflects key findings in the research literature (Chang, 2012; Li, 2006; Machado & Chung, 2015) regarding the importance of principal leadership related to technology integration and potentially suggests an area of support needed for BPS.

Additionally, the principal maintained that technology became a secondary concern when basic resources and manipulative materials were still absent from some classrooms, a concern also noted by the teachers. I intended to review the school technology plan and IPC lesson plans, but the principal revealed that no school technology plan existed since being open in 2012 nor was one in the process of development. Although the principal stated that a vision for technology integration to promote student construction of knowledge and 21st century skills was essential in BPS, the need for a current technology plan corroborated teacher interviews that pointed to a misalignment between the goals and the reality in the school context. The principal explained, “On my list of things to do or in a strategic plan, we do need to actually implement a technology plan.” The principal noted that the Chinese language and mathematics programs did not have any technology components, which teachers interviews also corroborated. Participants provided no reason for this absence. This finding again connects back to the inconsistency in statements versus practice of some Chinese participants regarding their pedagogical beliefs.

Finally, the principal described three barriers to effective technology integration in BPS, outlining, "…the funding provided for different technologies, the actual infrastructure of the actual internet, and the WiFi system." The principal noted that 70% of the technology-related resources of the IPC curriculum employed at BPS were not accessible because of weak WiFi and the need for a VPN to access the websites abroad, which the context did not have. Despite providing a comprehensive list of issues facing technology integration at BPS, the principal did not offer any potential solutions or guidance on how administrative leadership would overcome these challenges, potentially pointing to principal leadership as a key barrier to technology integration at BPS as well.

Summary

Overall, these findings describe an environment that is facing multiple barriers to technology integration to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets. Although not surprising, the findings pointed to an agreement among both Chinese and international staff that technology was a necessary tool to engage students and provide important 21st century skills. This finding suggested teacher willingness was not an obstacle to technology in the BPS context, but as described in earlier data, it could merely reflect a socially desirable response and would require further in-depth investigation. PD emerged as a repeated need advocated by all participants once fundamental infrastructure issues were fixed. The success of a teacher PD program, however, hinges on the staff's ability to implement the strategies provided in it effectively. If fundamental components such as Wi-Fi and VPN access severely limit the use of the primary curriculum, a systematic technology plan and vision is necessary to address each primary obstacle to achieve the goal of improved teacher effectiveness. Finally, the context needs the support of principal leadership with the initiative and vision to tackle the challenges facing technology integration at BPS in a systematic manner that will allow teachers to improve their technology self-efficacy through high-quality PD and begin to integrate technology in their instructional practices once the infrastructure challenges are overcome.

Chapter Three

Exploring Teacher Professional Development

Technology-enhanced, student-centered learning experiences are important for teachers to foster the development of valuable 21st century skillsets with their students (Bellanca & Brandt, 2011; Partnership for 21st Century Skills, 2005). Workplaces require an ever-increasing diversity of innovative skills from their employees, including knowledge of emerging technologies and advanced critical thinking skills to confront complex issues, the ability to brainstorm creative solutions, the capacity to work in integrated teams, and the willingness to adapt to new situations, building a more competitive global economy than previous decades (ACTE, 2010; Ertmer & Ottenbreit-Leftwich, 2010). I used a networked model as a framework for organizing the interacting factors (Bronfenbrenner, 1994; Neal & Neal, 2013) associated with the problem of practice in Chinese schools.

The participants in the needs assessment study revealed that they support the idea of cultivating 21st century skillsets, such as communication, collaboration, problem solving, and creativity and innovation, using technology-enhanced, student-centered learning experiences. However, they need to increase their technology competency, self-efficacy, and instructional practices as well as their knowledge of 21st century skills to offer better support to their students. Several findings from surveys and participant interviews provided insight for any potential intervention design to affect positive change in participants regarding these four areas of focus. First, teachers requested PD to support knowledge growth and experiences using technology in the classroom to improve their self-efficacy as many wanted to develop mastery skills with technology. Second, teachers desired more practice and hands-on experience with technology tools to raise the use of technology-enhanced activities beyond basic classroom tasks, such as presenting through PowerPoint presentations and word processing. Finally, participants universally expressed the need for technology-focused inservice PD to improve their technology use, competency, and self-efficacy in the classroom to cultivate 21st century skillsets with their students. The interrelationship of these factors needs to be investigated through a networked lens to describe the bidirectional interactions between the different constructs appropriately.

This chapter consists of a literature review focused on the identified research problem. The specific goal in this review is to highlight existing literature concerning the research problem from general to specific context and provide a rationale for the current study. The chapter focuses on PD-related literature and includes discussions on themes arising from the theoretical framework of the study, focusing on social cognitive theory and situated learning theory, delivery formats of PD, key components of PD, and the advantages of PD. Since the review aims to examine the findings from existing research to provide context and rationale for the current study, the structure aligns with this focus. It consists of four main sections. The first section includes the theoretical framework of the study, which consists of social cognitive theory and situated learning theory. In the second section, a broad review of PD literature is presented, including key components of effective PD systems. In the third section, I review PD delivery formats and their advantages, highlighting areas of focus for the study's intervention. Finally, I conclude the literature review with a summary of the chapter.

Raising the Bar: A Dual Theoretical Framework

The study's theoretical framework highlighted the complex network of interwoven factors impacting educators' abilities to integrate technology to support students' development of 21st century skills. Figure 1.2 displays the initial conceptual model that was the basis for the needs assessment study. The present section, however, accounts for the original conceptual model and takes up the cognitive and situated learning perspectives as frameworks for this investigation. Figure 3.1 displays the revised conceptual model in the form of a causal diagram that aligns with the intervention and notes bidirectional as well as cyclical relationships. The dual theoretical framework for the study supports the revised conceptual model, describing two fundamental theories, social cognitive theory and situated learning theory, which demonstrate how PD can enhance the needed areas of teacher development.

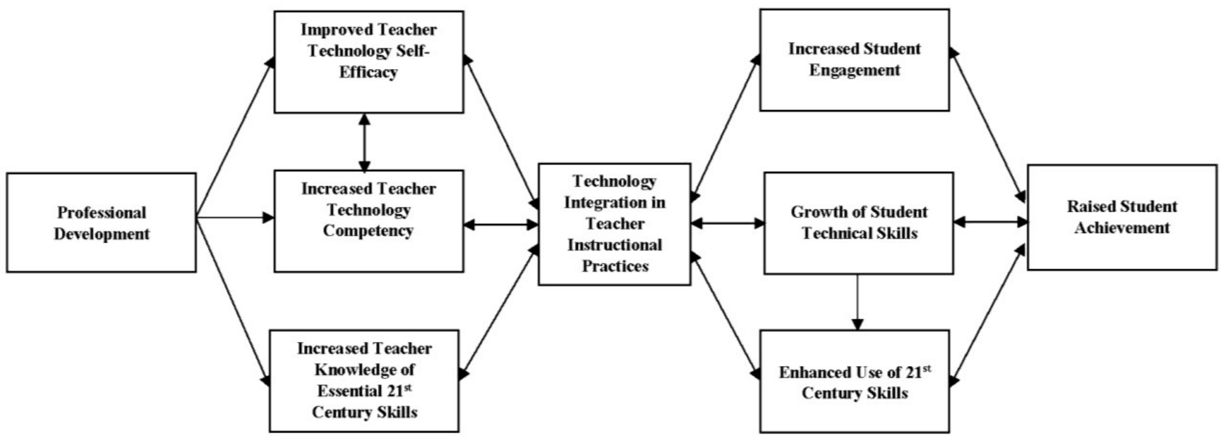


Figure 3.1. Revised Conceptual Model

The intervention literature review highlights the relationships between the variables noted, describing an ongoing, cyclical process of improvement relative to the key variables.

Several changes were made from the original conceptual model (see Figure 1.2) to create a more actionable intervention that aligned with the intervention literature summarized within this chapter as well as the dual theoretical framework for the intervention described below. I removed infrastructure and school resources as well as principal leadership due to an inability to influence these factors directly. Additionally, the model was condensed to focus less on teacher beliefs (i.e., teacher pedagogical beliefs and teacher epistemological beliefs) and student beliefs and instead integrate ideas from the intervention literature regarding PD's ability to impact teacher technology self-efficacy (Cheung, 2008; Li et al., 2012; Long et al., 2013), proficiency (Chang, 2012; Dawson & Rakes, 2013; Li, 2006; Zhou et al., 2011), instructional practices enhanced by technology (An & Reigeluth, 2014; Li et al., 2012; Liang et al., 2007; Spires et al., 2012), and teacher knowledge of 21st century skills (Ertmer & Ottenbreit-Leftwich, 2010; Tay et al., 2015). As the revised conceptual model shows, the relationships of these factors are bidirectional as well as cyclical with the improvement of one often positively influencing another. Teacher development in these areas then leads to the long-term outcome of student achievement (Borko, 2004; Darling-Hammond, 1999; Law et al., 2008; Li et al., 2012). The dual theoretical framework discussed below supports the revised conceptual model, describing two fundamental theories, social cognitive theory and situated learning theory, which demonstrate how PD can enhance the needed areas of teacher development.

Social cognitive theory. Social cognitive theory, also known as social learning theory, developed as a response to behaviorism and cognitivism by Bandura (1977b, 1986), acting as a theoretical bridge between the two approaches to learning. Although Bandura agreed with some of the ideas of behaviorism regarding the impact of the environment on an individual, he noted that learned behavior was not the simple development of a stimulant acting upon the learner and causing a response. In between this process of stimulus and response, mediating processes occur in four distinct stages: (a) attention, when the learner sees the behavior, (b) retention, when the learner remembers the behavior, (c) reproduction, when the learner develops imitation ability, and (d) motivation, when the learner has the willingness to perform the behavior (Bandura, 1977b, 1986). These mediating processes affect the level of response from the learner.

Additionally, Bandura (1977b, 1986) proposed that behavior is learned from the environment through observational learning, which requires cognitive processes. The cognitive perspective, or cognitivism, focuses on the construction of mental frameworks and the cognitive processes that individuals use to construct knowledge (Bandura, 1986). The importance of cognitive theories and approaches lay in their emphasis on learner reception, organization, storage, and retrieval of knowledge (Schunk, 2012). Deep learning requires learners to be active participants in the learning process, a connection of new knowledge to prior knowledge and experience through cognitive strategies, integration of new insight into existing mental schema and patterning, an understanding of the cognitive process, and reflection on the learning process by the learner (Sawyer, 2005; Schunk, 2012). Attention plays a fundamental role in this in-depth learning process, allowing individuals to attach significant meaning to new learning as well as engage in the active recall of learned information (Schunk, 2012).

Social cognitive theory describes how a person functions through a model of triadic reciprocity involving behavior, personal, and environmental aspects all influencing one another (Bandura, 1977b, 1986). Behavior involves elements of complexity, duration, and skill; personal integrates cognition, self-efficacy, motives, and personality; and the environment involves aspects of the situation, roles, models, and relationships. The triadic reciprocity model proposes continuous interaction between these three factors (Bandura, 1977b, 1986). These factors transmit information to the observer, providing cues to learning, strengthening or weakening the learner’s existing restraints, and demonstrating new patterns of behavior (Bandura, 1977b, 1986). Rather than employing a behavioral method of merely acting and suffering consequences, individuals actively test potential options through rational problem solving and use advanced cognitive reasoning skills, forethought and vicarious capability, the ability to learn by observing others, as well as self-regulation and self-reflection to make decisions and cultivate new ideas and knowledge (Bandura, 1986).

Social cognitive theory provides a lens on high-quality, effective PD, which involves hands-on, authentic learning experiences in which learners are active participants in their learning process and need to monitor their cognitive process and development while observing others and interacting with the environment (Desimone & Garet, 2015; Hu, Zhou, & Li, 2014). Teacher participants during PD need to construct new mental frameworks and deeper understandings of technology applications with their students through the connection of prior and new knowledge through active learning exercises, such as applying technology lesson plans with their students and then reflecting upon the experience. Teachers need to be active participants in their learning through observation, and through this hands-on engagement, they will deepen their understandings (Sawyer, 2005; Desimone & Garet, 2015). Self-awareness and self-regulation are associated with the development of self-efficacy as individuals engage in self-reflection on their experiences as well as motivate and regulate themselves through internal standards and self-evaluative reactions of their actions, therefore impacting their confidence in a particular task and decision-making process (Bandura, 1977a, 1986).

Technology integration often requires extensive PD to build the requisite expert skills to implement it in the classroom as well as navigate any problems that arise (Cheung, 2008; Long et al., 2013; Pan & Franklin, 2011; Zhou et al., 2011). Social cognitive theory describes the foundation of learning new knowledge through observation, imitation, and practice (Bandura 1977b, 1986), which help a teacher develop from a novice to an expert through the guidance of more experienced facilitators in quality PD (Brinkerhoff, 2006; Lave & Wegner, 1991; Martin et al., 2010). Internal social interaction processes nurture educators' learning and development through shared learning communities (Kearney, 2015; Lave & Wegner, 1991; Wenger, 1998). This theoretical perspective is a lens from which I can view the adult learning in the intervention, helping to understand participants' cognitive processes, interaction with the environment and peers, and behavioral adoption of new strategies based on observational learning. This approach helps to explain learning and assists teachers in overcoming their learning barriers through self-observation, self-awareness, and self-regulation (Bandura, 1978).

Within the present study, the theoretical perspective offers insight into guidelines for crafting an effective PD intervention that will provide the elements necessary for productive learning, specifically related to the three core aspects of the triadic reciprocity model as well as observational learning and mediational processes. It suggests creating a foundation of context-relevant (Reeves & Pedulla, 2013; Vavasseur & Kim MacGregor, 2008), practical experiences (Donovan, Hartley, & Strudler, 2007; Yan & He, 2012) with formative feedback for assessment for a PD program (Claesgens et al., 2013; van Tryon & Schwartz, 2012). It also suggests that PD should address beliefs (Li et al., 2012; Liu & Feng, 2015) and engagement (Henderson, 2007; Prestridge & Tondeur, 2015), and it should also maintain a focus on elements of self-efficacy and self-development (Garet et al., 2001; Martin et al., 2010; Loucks-Horsley et al., 1996; Oddone, 2016) as well as social interaction (Kim & Cavas, 2013; Lock, 2006; Snow-Gerono, 2005). I discuss the key points and studies explaining how I will use the theoretical perspective in detail in the intervention literature review section.

Situated learning theory. Situated learning theory focuses on the interdependent relationship between the individual and the world associated with the process of learning, cognition, and understanding and emphasizes the social phenomenon of meaning-making and coming to understanding of a phenomenon through participation in communal activity, practice, and thought (Lave, 1991). Situated learning theory and legitimate peripheral participation engage an adult learner as an active member of an integral social framework of thinking, knowing, and learning, focusing on the teacher as a learner (Kearney, 2015; Lave & Wegner, 1991; Wenger, 1998), leading to improvement through the process of collectivism and shared experience.

Legitimate peripheral participation refers to how novices become experts in a community through observation, interaction, and communication with more experienced members (Lave & Wegner, 1991). Learners do not necessarily create or acquire new models to understand the environment around them but engage in a community that has structure and helps cultivate and construct new identities for them related to the focus of the group (Wenger, 1998). Framing a learning community from a situated learning perspective involves sharing knowledge and practice through activities, artifacts, strategies, ideas, and identities (Lave & Wenger, 1991). According to this theory, explanations of learning are less focused on internal cognitive processes but on the process of engaging as a full member of a socio-cultural environment (Lave & Wenger, 1991). Additionally, participation does not necessarily need to occur face-to-face, but instead participants can interact in physical isolation with others if it is part of a system of social practices and members are engaging in those social practices (Greeno, 1997). In this sense, context is defined as participation in a specific social practice, not a physical space (Greeno, 1997; Lave, 1988).

Situated learning theory holds that learning occurs within a CoP (Lave & Wegner, 1991), which is increasingly regarded as a productive and effective manner to conduct PD. These communities involve an ongoing, reciprocal learning process related to best practice sharing, often using the experience and knowledge of expert teachers to scaffold the learning of novice members (Kearney, 2015; Lave & Wegner, 1991). Teachers can connect with like-minded individuals and enhance their current instructional skillsets, therefore leading to advantages in the classroom and ideally learning. If educators engage in a problem-based, self-directed community of learning, their education is often more meaningful and applicable to practice (Blitz, 2013). Although not inherently an online model of social learning, a CoP provides a multitude of potential benefits when considered within an online, readily accessible environment. In a Chinese context, the rise of WeChat as a social media and communication platform provides a medium for an online CoP with the ability to connect as many as 500 participants across the country in real time to share pictures, videos, and articles. WeChat has emerged over the last few years as the most popular communication platform for the Chinese population.

Situated learning theory provides a foundation for the present study based on its relationship with PD, CoPs, and online communities, offering guidance regarding positive social interactions between educators and how they can improve their learning through peer interactions and knowledge sharing (Kearney, 2015; Lave & Wegner, 1991). The exchange of knowledge between beginning teachers and their expert peers is especially relevant, allowing for peer scaffolding to enhance the learning of novices through a dialogue of ideas (Lave & Wenger, 1991; Wenger, 1998). Situated learning theory provides the framework for interaction within CoPs with legitimate peripheral participation highlighting this beneficial relationship, which develops between newcomers and experienced members to heighten the learning experience as well as the exchange of practical knowledge, guidance, and advice for the classroom.

Additionally, situated learning theory offers a useful framework for educators relative to the integration of technology within their classrooms along with involving students in a group learning process, which allows for a shared space of problem solving and interaction to overcome issues through consultation with more experienced peers (Bell, Maeng, & Binns, 2013). It also expands their knowledge through collegial sharing related to classroom practice with other educators (Booth & Kellogg, 2015; Vavasseur & Kim MacGregor, 2008). Educators can enhance their learning, thinking, and construction of knowledge in an authentic environment with coaching from more experienced teachers as an integral component to support their students through stronger technology integration strategies (Bell et al., 2013). It is a learning environment of mutual engagement and shared repertoire all toward the goal of improved educator knowledge.

As a learning theory based on the cultivation and sharing of ideas, activities, strategies, and artifacts within a social environment, situated learning theory offers a fundamental guiding approach for an intervention engaging participants in a CoP (Lave & Wenger, 1991; Wenger, 1998). The theory is an essential component of community-focused PD intervention options as it highlights the power of legitimate peripheral participation and exchange of knowledge among teachers. Specifically, the point that social interaction can remain beneficial when participants work within physical isolation yet engage in and share similar social practices (Greeno, 1997; Lave, 1988) is highly relevant to an online CoP with participants from multiple contexts, which is under consideration within the present study. As situated learning theory focuses on the interdependent learning relationship between the individual and the world, it also relates to critical elements of 21st century learning, including collaboration and teamwork, which enhanced the interconnected nature of the learning environment and expectations of the present study's intervention. In an increasingly interlinked, social world, situated learning theory provides the perfect approach to learning, cognition, understanding, and knowing through participation in a CoP (Lave, 1991; Lave & Wenger, 1998).

Professional Development as an Intervention

In this section, I present a review of the literature in which I discuss PD as an intervention. It consists of four subsections, which include (a) an overview of PD as an intervention, (b) the key components of effective PD systems, (c) the different PD delivery formats and their overlapping advantages, and (d) a summary of why I selected the modalities of

PD I did in the context of the study. The review serves two purposes. First, it provides background related to potential interventions within the existing body of literature. Additionally, the review highlights the gaps in the current research that the study will address.

Overview of Professional Development as an Intervention

As an intervention, PD programs provide educators with the context in which to develop the requisite skills to address student needs in the classroom (Garet et al., 2001; Guskey, 2002; Lawless & Pellegrino, 2007; Loucks-Horsley et al., 1996; Wilson & Berne, 1999). PD is an essential component of ongoing educator support, particularly when considering technology-enhanced, student-centered learning experiences that involve professional learning with new and innovative technology tools and teaching strategies, such as in the context of the present study in which the focus is on technology adoption. As a broad potential solution, PD programs and aspects of those programs encompass a myriad of choices, providing an avenue of investigation related to the dual theoretical framework of social cognitive theory and situated learning theory. This literature review also informed the development of the revised conceptual model (see Figure 3.1).

Enduring change in teachers and students comes from a temporal sequence of events related to PD (Guskey, 1986, 2002). Guskey (2002) describes a model of teacher change that led to long-term changes in teachers' attitude and perceptions of learning. This model of teacher change asserts four steps, building from one to another and suggesting the sequence of outcomes of PD. First, educators experience PD. Based on the PD received, teachers make changes in their classroom practices employed with students, which then, in turn, lead to a change in students' learning outcomes. Meaningful change in teachers' attitudes and beliefs only occurs once they see evidence of student learning improvement in the classroom because of the PD supported strategies, a critical point stressing the importance of successful implementation (Guskey, 2002).

The model emphasizes important implications for any PD program with the goal of enduring teacher growth, providing fundamental guidance to the intervention of this present study. PD programs need to recognize that change is a challenging and gradual process for educators (Guskey, 2002). Additionally, PD programs need to ensure that educators receive regular feedback regarding student progress and are offered ongoing follow-up support as well as pressure for their continual professional learning (Guskey, 2002). It is fundamentally important to understand the process of teacher change to employ PD programs, as it will offer permanent growth rather than short-term, temporary development for teachers.

Teacher change, however, is not necessarily a linear process (Clarke & Hollingsworth, 2002). Although Guskey (1986, 2002) suggests a linear model of change, Clarke and Hollingsworth (2002) describe an interconnected, non-linear model of professional growth based upon three Australian empirical studies. The first study involved an examination of the professional learning over 18 months of 18 Catholic school mathematics educators, all of whom participated in the Active and Reflective Teaching in Secondary Mathematics PD program (Clarke, Carlin, & Peter, 1992). The second study, led by Hollingsworth (1999), involved a longitudinal study of six primary school teachers from four different Melbourne schools over 18 months in the Exploring Mathematics in Classrooms PD program. Finally, the third, 4-year study, called the Negotiation of Meaning Project, involved a study of classroom observational video data of 55 grade 7-10 high school mathematics and science lessons, which were supported by post-lesson data from student and teacher interviews (Clarke 1997, 2002). As a result of an in-depth, integrated review of these three empirical studies, the authors created the foundations of their professional growth model described below.

The interdependent model developed by Clarke and Hollingsworth (2002) is comprised of four domains, including the personal domain (i.e., knowledge, beliefs, and attitude), external domain (i.e., an external source of information or stimulus), domain of practice (i.e., professional experimentation), and domain of consequence (i.e., salient outcomes). This model identifies the mechanisms of change related to each area and the network of non-linear interactions between each, allowing for a structure of change for teachers that highlights the individual nature of PD and the different pathways of development teachers can take (Clarke & Hollingsworth, 2002). These bidirectional mechanisms of change involve the mediating processes of enactment and reflection, which describes how a change in one domain led to change in another. Enactment refers to a teacher's transfer of a belief or pedagogical model from PD into action, and reflection refers to their self-awareness of the process and its success. This non-linear model, as well as the linear model proposed by Guskey, explains the research findings across multiple instantiations related to the need for a high-quality framework to form the foundation of teacher learning PD programs, providing guidance for the creation of a PD intervention for this present study.

In a seminal article on PD, Borko (2004) described the elements that require consideration and integration to establish an effective, high-quality PD intervention. These elements include (a) the PD program, (b) the teachers, who are learners in the system, (c) the facilitator, who guides the participants in their construction of new knowledge and practices, and (d) the context in which the PD program occurs. Each of these components represented inputs that must be included in a logic model for an intervention program such as the one under focus in the present study, highlighting the foundation upon which one should base the activities and participation elements. As an intervention, there are multiple important outcomes of PD, including the ability to transform teacher knowledge and practices, the creation of quality professional communities to cultivate teacher learning, and the recording of methods that are reliable tools for teacher learning (Borko, 2004).

Further, as a professional learning approach, high-quality, ongoing PD cultivates improvement in teaching abilities as well as fosters new skills to better support teacher learning (Holmes, Signer, & MacLeod, 2010) such as those required for technology integration in the classroom and curriculum as well as self-efficacy for teachers to improve students' skillsets (Garet et al., 2001; Martin et al., 2010; Loucks-Horsley et al., 1996; Oddone, 2016). Both of these are central to improving teacher self-efficacy related to technology (Dai et al., 2011; Martin et al., 2010; Vavasseur & Kim MacGregor, 2008; Zhan, 2008; Zhou et al., 2011). PD can help improve teacher self-efficacy through mastery experiences, vicarious experiences of peers, verbal persuasion and guidance from coaches, and physiological responses (Bandura, 1977a; JohnBull, 2017; JohnBull, Hardiman, & Rinne, 2013; Pajares, 2002). High-quality PD may also lead to student achievement (Borko, 2004; Darling-Hammond, 1999; Law et al., 2008; Li et al., 2012) as well as student engagement (Williams, Atkinson, Cate, & O'Hair, 2008) through teacher development described in the revised conceptual model of the present study (see Figure 3.1). Additionally, PD programs that involve and address teachers' beliefs and practices in the program activities lead to positive perceptions of technology integration and technology-enhanced teaching practices (Chikasanda, Otrel-Cass, Williams, & Jones, 2013).

The most productive PD programs challenge teachers' ideas about student learning and develop their knowledge in ways that improve student achievement (Jensen, Sonnemann, Roberts-Hull, & Hunter, 2016). High-quality PD systems are essential to promote the cycle of continuous professional learning in a context, fostering learning organizations that encourage teacher growth on an ongoing basis (Jensen et al., 2016). Key elements of this transformation in a context include school improvement organized around effective PD, the creation of distinctive PD leadership roles at the school and systems level, the recognition of the development of teacher expertise, shared responsibility of professional learning, and the integration of professional knowledge into daily activities (Jensen et al., 2016). Evaluation and accountability are also vital components to foster an effective PD system and learning environment (Jensen et al., 2016).

Not all teachers feel, however, that PD improves students' learning and development (Guo & Yong, 2013). Guo and Yong explored the attitudes regarding PD of twelve inservice early childhood teachers in China drawing on a phenomenological perspective, which consisted of semi-structured focus group interviews evaluated through a content analysis approach. The teachers reviewed the thematic topics generated by the data analysis to ensure they accurately represented their important views. The study revealed PD as an effective method to support professional identities, skills, knowledge, relationships with colleagues, and professional responsibilities. The teachers, however, often do not see explicit relationships between government guided PD policies and practices and student achievement or child-centered instruction. Additionally, emphasis on teaching performance and its competitive approach limit the professional learning experience as well as the potential to focus on children's learning improvement (Guo & Yong, 2013). This study links back to several of the factors and barriers identified in Chapter One's literature review that influence education and teacher development in China, identifying key considerations to keep in mind for this study's intervention that may negatively impact the effect of PD on participants.

In this regard, teachers often may require the support of comprehensive, culturally responsive PD to overcome contextual challenges (Avalos, 2011; Dai et al., 2011; Sang et al., 2012). This approach to PD can positively impact teachers' epistemological beliefs, teachers' pedagogical beliefs, and teachers' self-efficacy toward instructional practices that successfully integrate technology (Li et al., 2012; Liu & Feng, 2015). Avalos (2011) conducted a metanalysis of PD research from 2000 to 2010 and emphasized that the way contextual factors relate to teacher learning needs depends on a country's traditions, cultural values, government policies, and school conditions. Although teachers in different cultures progress in their professional learning in similar manners and some elements of effective PD are consistent across contexts, there is not a single model of PD that applies to all environments (Avalos, 2011). As highlighted in Chapter One of the present study, culturally relevant PD is essential when considering adapting Western technology-enhanced, student-centered education ideas for a Chinese context (Dai et al., 2011). Sang and colleagues (2012) highlighted how cultural context played a fundamental role in the formation of teacher beliefs in China, and constructivist ideas held by teachers changed due to classroom realities, causing them to embrace more traditional lecture-based approaches. Beliefs are essential to teacher learning development, which is supported by the literature on technology integration in a Chinese context and details the need to impact teacher's core belief systems to enact positive development (Dai et al., 2011). It suggests the need for the PD intervention of the present study to consider the role of the cultural context in the program's structure and how it will impact participating teachers' learning.

PD also needs the support of capable principal leadership to be adequate and compelling (Machado & Chung, 2015). As described in Chapter One of the present study, supportive administrative leadership provides a fundamental foundation for teachers to integrate technology effectively in their classrooms as well as cultivate a culture of technology in the context (Chang, 2012; Machado & Chung, 2015; Kurland et al., 2010). This leadership is also needed for the development and execution of PD to foster the skills teachers need for effective integration (Chang, 2012; Machado & Chung, 2015). For teachers to effectively integrate technology into instructional practices to improve student understanding and cultivate 21st century skills, Ertmer (2005), Ertmer and Ottenbreit-Leftwich (2010) and Tay and colleagues (2015) establish that each of these factors needs to function in tandem in a cohesive, unified manner.

Moreover, engagement and motivation are key to keeping teachers engaged in models of learning (Keller, 1987). In the Attention Relevant Confidence and Satisfaction (ARCS) Model, Keller (1987) explored whether it is possible to synthesize the many ideas surrounding motivation into one instructional model involving the four main conditions, which is systematic and can lead to motivating individuals. The model examined effective manners in which to understand motivation as well as use it as a structured, instructional design tool. For each of the four significant conditions of attention, Keller noted the multitude of factors to consider as well as detailed prescriptive motivational strategies in which to raise the element to a satisfactory level leading to achievement. Through instructional design steps of define, design, develop, and evaluate, the ARCS model offers a roadmap for working with students, particularly in contexts where motivation is a critical driving force, such as online PD. The ARCS model was important to use in the instructional design of the present study's intervention considering the high attrition rate in online courses, such as mass open online courses, which are voluntary versus mandatory. As the current study's intervention was optional with recruitment from multiple contexts, ARCS was used in its design to help focus on maintaining adequate levels of intrinsic motivation that see participants continue to completion.

Despite the highlighted benefits of teacher PD in multiple studies (Holmes et al., 2010; Garet et al., 2001; Martin et al., 2010; Loucks-Horsley et al., 1996; Oddone, 2016), teacher learning does not occur without thoughtfully-planned and well-executed PD (Guskey & Yoon, 2009). Guskey and Yoon conducted a research synthesis of 1,300 PD studies that highlighted the complex process of implementing PD programs that lead to student achievement. The authors emphasized just-in-time, job-related support as important for teachers employing new instructional strategies as well as the time requirements of PD, which needs to be well organized, structured, direct, and content focused. PD program designers and administrators need to learn how to critically measure and evaluate the effectiveness of the programs that they implement (Guskey & Yoon, 2009). The need for this enhanced evaluation highlights a critical area of consideration for the intervention and points toward the need for an effective PD system (Darling-Hammond, Hyler, & Gardner, 2017).

Key components of an effective PD system. An effective PD system involves structured professional learning, which integrates elements of practice to support the increasingly sophisticated skills needed by students to prepare for challenges in the 21st century workforce and includes various components (Darling-Hammond et al., 2017). An analysis of over three decades of PD research highlights seven elements of effective PD (Darling-Hammond et al., 2017). PD needs to be (a) content focused, incorporating (b) active learning for educators focused on the actual material they will be using in the classroom. This dynamic learning process needs to support (c) collaboration with other educators in the PD sessions in the classroom with students, (d) using models of effective practice that educators can translate to real application. It needs to (e) provide coaching and expert support that can (f) offer feedback and reflection on technology-related practices. Technology support staff provide powerful PD benefits onsite for educators in contexts that can afford to employ them (Brinkerhoff, 2006; Claesgens et al., 2013; Swan & Dixon, 2006; van Tryon & Schwartz, 2012). Finally, PD needs to be of (g) sustained duration as short-term, single instances of professional support may be ineffective (Darling-Hammond et al., 2017). Through a synthesis of these seven components, an intervention can address the fundamental elements that lead to successful teacher growth and student development (Darling-Hammond et al., 2017).

Similar to Darling-Hammond and colleagues (2017), the Professional Development Project of the National Institute for Science Education investigated PD involving science and mathematics, similarly asserting seven principles of high-quality PD (Loucks-Horsley et al., 1996). These principles include: (a) being driven by an explicit definition of teaching and learning, (b) offering opportunities for teachers to expand their knowledge, (c) employing learning strategies that mirror student learning, (d) strengthening learning communities, (e) preparing teachers for leadership roles, (f) offering connections to other parts of the education system, and (g) including continual assessment. From the analysis of these two studies, it is clear that there is a need for a multi-faceted approach to the PD intervention for the present study, which integrates useful elements noted across multiple studies to ensure a lasting impact.

Moreover, duration is a factor of crucial importance regarding the impact of a PD program (Brinkerhoff, 2006; Davidson, Fields, & Yang, 2009; Jackson et al., 2006; Martin et al., 2010; Yoon, Duncan, Lee, Scarloss, & Shapley, 2007). Long duration and higher intensity programs often result in more beneficial results than shorter length programs (Brinkerhoff, 2006; Desimone & Garet, 2015; Kanaya, Light, & Culp, 2005; Yan & He, 2012). Previous research, however, notes that PD programs with a minimum of 14 hours in total duration regularly demonstrate a positive impact on student achievement (Yoon et al., 2007). Programs with a length of 21 hours (Davidson et al., 2009) and 44 hours (Jackson et al., 2006) also have demonstrated benefits for participant teachers in target areas of instructional improvement. Additional research is necessary to highlight an exact timeframe of PD duration effectiveness.

Other components of PD programs targeted at teachers suggested in the seminal literature include (a) an approach centered on reform that (b) ensures training is practical and can help teachers apply teaching strategy results directly to the classroom (Desimone, 2009). PD should include (c) innovation concerning instructional technologies and specification of a definite goal for student outcomes. (d) Activities should emphasize active learning, (e) in which teachers' knowledge and beliefs are connected and (f) that have adequate duration to ensure a substantial impact. Finally, (g) PD programs should encourage collaboration within the learning process (Desimone, 2009). These characteristics of PD noted in existing research expand upon a five-part framework advocated in previous research, which involved extensive content focus, integration of active learning, collaboration elements, alignment with context curricula, and proper duration (Desimone, 2009). Many of these components highlighted by the author align with those noted by Darling-Hammond and colleagues (2017) as well as Loucks-Horsley and colleagues (1996), revealing important elements for a PD system to be successful.

Similar to Desimone (2009) but through the application of an empirical study, Martin and colleagues (2010) focused on identifying elements of PD program design that positively impact teachers. An evaluation of enhancing Missouri's Instructional Networked Teaching Strategies (eMINTS) involving 269 teachers from 71 schools in 10 total districts defined eight components of effective PD. eMINTS was an extensive, 2-year program including approximately 250 hours of PD and support along with ten to twelve classroom visits per year. The program activities focused on technology integration through assessment, community building, collaboration, and inquiry-based learning among teachers and students. The authors used a three-phase approach during the program evaluation study, first reviewing important elements and creating an instrument to analyze fidelity of implementation. Then they examined the impact of fidelity and teacher understandings on student outcomes. Effective PD is (a) sponsored by a university and implements (b) a reform approach, a method that provides teaching strategy results directly applicable to the classroom, in this case linking technology and pedagogical practices. High-quality PD should also (c) introduce innovative instructional technologies and (d) describe an explicit goal of student achievement related to the problem, (e) employing active learning in its activities. These activities should (f) connect to teachers' beliefs and knowledge. Finally, the program should (g) have proper length to guarantee a strong impact as well as (h) foster collective collaboration as part of the learning process (Martin et al., 2010). High fidelity to PD programs and demonstration of program concepts focused on lesson planning time, reflection within practice, community building ideas, technology utilization, and problem solving improve teacher development, enhance teacher knowledge and effectiveness outcomes, and raise student achievement over time (Martin et al., 2010). These ideas, particularly the importance of program fidelity, provided guidance to the process of the present study's intervention.

Comparably, in their seminal article, Desimone and Garet (2015) highlighted similar best practices in teachers' PD and noted five key features: the focus of the content, active learning, coherence, sustained duration, and collective participation. The study analyzed current research from the United States, including cross-sectional studies, longitudinal studies, literature reviews of qualitative and quasi-experimental studies, and recent randomized control trials. Desimone and Garet highlighted a direct relationship between PD and classroom instruction, similar to what is described in the revised conceptual model of the present study (see Figure 3.1). PD associated with classroom-related content leads to more participant achievement, and administrative leadership is vital to the effective implementation of PD practices (Desimone & Garet, 2015). Additionally, altering classroom behavior is more actionable that impacting educator content knowledge or inquiry-based instructional strategies. Feedback loops with expert teachers and ongoing monitoring are also critical to the novice educator development process.

By integrating robust PD models (Clarke & Hollingsworth, 2002; Guskey, 1986, 2002) of teacher change as well as principles of effective PD (Darling-Hammond et al., 2017; Desimone, 2009; Desimone & Garet, 2015; Loucks-Horsley et al., 1996), the present study can employ an intervention that will offer beneficial growth in skills, knowledge, and self-efficacy to participating educators (Dai et al., 2011; Garet et al., 2001; Holmes et al., 2010; Martin et al., 2013) using contextually-based learning and activities that involve the practice of cognitive skills, both elements of social cognitive theory (Bandura, 1977b, 1986). Through comprehensive, culturally responsive PD, the intervention will have the capacity to influence teacher beliefs and motivation, an important approach especially when adapting Western technology-enhanced, student-centered education ideas in Eastern contexts (Avalos, 2011; Dai et al., 2011; Sang et al., 2012). It is also crucial to plan efficiently to evaluate the intervention's effectiveness (Guskey & Yoon, 2009) through a comprehensive PD system (Darling-Hammond et al., 2017) to ensure participants receive the most benefits from the program activities and transfer these benefits to their students as detailed in the revised conceptual model of the present study (see Figure 3.1).

The goal of this subsection of the literature review was to discuss components that are central to PD to contextualize the factors that could influence teachers concerning technology adoption and PD. As a result, I synthesized the existing research, and I discovered seven specific components key to PD. These seven components include (a) proper duration, (b) adequate workload with a linear structure, (c) learner-centered focus, (d) inclusion of teacher concerns and voices, (e) engagement through actively experiencing technology tools, (f) collaborative environment, and (g) long-term, sustained support. I integrated all of these aspects within the study's intervention except the last item associated with long-term sustained support. Ongoing follow-up support was not a feasible component to include considering the limited length of the study. Based on a general review of PD literature as well as the positive, beneficial components in this study, PD programs will be explored as crucial underlying factors influencing technology use within the context of a school in China. Through a review of literature related to different modalities of PD in the next section, I will highlight the powerful advantages PD provides as an intervention option within a Chinese context to address the challenges facing K-6 teachers associated with technology integration to foster the development of 21st century skillsets in their students.

Professional Development Delivery Formats

In the previous sub-section, I discussed the overall value of PD as an intervention as well as the components of effective PD system. In the literature, researchers have noted the need to plan efficiently to evaluate a PD program intervention's effectiveness to ensure participants receive the most benefits from the program activities and transfer these benefits to their students. PD can occur in several formats, each of which has distinguishing characteristics. Due to the focus of the present study on PD as an intervention approach to address the identified problem of practice, it is essential to review the research related to the significant PD delivery formats to understand the value PD can provide as an intervention. As the current context faces specific constraints related to availability and dispersion of potential K-6 participants, I have already selected online PD coupled with a CoP as the most pragmatic option to offer beneficial support to participants as well as accessibility and flexibility considering their considerable scheduling constraints. Despite this selection, however, a more specific discussion of each modality of PD will suggest it as the only practical and effective intervention option to address the challenges facing K-6 teachers in a Chinese context related to technology integration to cultivate the development of students 21st century skillsets. This discussion will highlight commonalities between the formats and therefore shared advantages. In particular, I will review face-to-face and blended PD research to the extent to which I plan to draw upon their ideas for the intervention. In the following sections, the intervention literature review will synthesize research covering face-to-face PD, blended PD, online PD, and CoPs.

Face-to-face professional development programs. Face-to-face PD programs often follow an inservice model of workshops delivered by either external or internal trainers and work to improve teacher knowledge and strategies regarding a specific skill area (Wells, 2007). These workshops often involve hands-on activities and interactions coupled with live lectures to work to improve teacher knowledge and practices in the classroom. Although not selected as the modality of choice for the intervention due to logistical concerns (e.g., availability of participants, geographic dispersion of participants, financial expense), research related to face-to-face PD programs provides insight as to the selection of PD as an intervention option with many of the benefits overlapping with the actual choice of online PD coupled with a CoP. The following section will highlight that associated research.

Teachers' perceptions regarding the coherence of PD related to learning and teaching play a significant role in a PD program's effectiveness (Penuel, Fishman, Yamaguchi, & Gallagher, 2007). The study included 454 teachers from 28 geographically different contexts involved in the GLOBE Program of PD over two years. It investigated the impact of various elements of PD on teachers' knowledge and ability to implement material learned from the program (Penuel et al., 2007). Within the program, GLOBE participants devoted a significant amount of their time to plan classroom implementation of GLOBE-related activities through the use of active learning strategies, modeling, and hands-on, authentic learning during training. The program also helped them align the GLOBE activities with local standards and provided potential access to needed equipment. The authors employed a survey measuring teacher knowledge and practice. A third independent measure was used to collect data on program implementation related to material and support provided to teachers. The study discovered that teachers' interpretations of PD activities were critical for the effective implementation of those activities with students, and teachers' overall perception of a PD experience addressing their specific classroom needs also impacted later application. Proper planning time, as well as onsite support, are elements needed for teachers to translate learning from face-to-face PD into effective practice in the classroom (Penuel et al., 2007). Additionally, even if a program involves an expert provider across multiple contexts, it is important to consider how to localize it to different settings, accounting for the demands it places on teachers as well as teachers' needs.

Long-term, professional PD models, however, are not the only face-to-face approaches that improve teacher-related factors (Shriner et al., 2010). Even brief PD experiences can alter teacher technology self-efficacy, integration practices, and general perceptions regarding the use of technology to support student learning (Shriner et al., 2010). Shriner and colleagues (2010) explored technology self-efficacy related to social studies instruction among 177 United States K-12 educators in three different workshops, which were created based on survey feedback from 20 social studies PD faculty and focused on participant-suggested activities. The first workshop focused on providing teachers with instruction on giving virtual field trips. The second workshop highlighted various technology resources teachers could use to teach social studies to students. Finally, the third workshop focused on technology resources to support teaching geography and history of the world. The study employed pretest and posttest, 5-point Likert scale surveys, which were analyzed using a paired *t* tests to determine the degree teachers' perceived confidence, competence, and resultant content-specific self-efficacy varied due to the three different workshop approaches. The authors discovered significant gains in self-reported competency and confidence regarding technology integration in social studies instruction. Even short-term PD transformed teacher self-perceptions and therefore led to positive changes in teacher confidence. The engagement in a collaborative, content-centric environment with expert-modeled activities proved highly transferable from the viewpoint of the educators to classroom practice. Shriner and colleagues' findings support the revised conceptual model (see Figure 3.1), associating PD with the positive development of teacher technology self-efficacy, competency, and instructional practices ideally leading to long-term benefits for students.

Further, Walker and colleagues (2013) described how delivery content in similar technology-focused, face-to-face PD programs impacts student achievement success. An investigation explored the difference in the influence of a PD program with exclusive technology-focused activities compared to a similar program with technology-focused and problem-based learning activities using teacher pre- and post-surveys, web usage data, a problem-based learning rubric, and a student questionnaire. This quasi-experimental study of 51 junior high school teachers detailed increases for teachers in both programs in the instructional integration of technology, knowledge, and skills. The technology and problem-based learning group, however, demonstrated significantly higher improvements in self-assessed knowledge. An additional survey of 1,247 students emphasized that only those in classes of teachers who participated in the dual PD model made significant gains in the three areas measured: behavior, knowledge, and attitude. PD positively impacts teacher knowledge and skills, aligning with other studies which noted PD programs' positive influence on teacher development (Borko, 2004; Martin et al., 2010; Shriner et al., 2010), but particularly impacts student achievement when it involves technology-focused and problem-based learning content (Walker et al., 2012).

Although the content focus is important (Walker et al., 2012), PD should also address teacher concerns and needs, providing participants a voice in the process and maintaining informational awareness regarding new and innovative practices (Donovan et al., 2017). Donovan and colleagues (2007) evaluated the transition of a one-to-one laptop initiative for 17 urban middle school educators through a Concerns-Based Adoption Model of change, which offers a research-supported framework to assess teacher concerns in the initial implementation period and focuses on individuals as the primary agents of change. The mixed methods study, employing a survey and interviews, described two types of teacher concerns that PD needs to address: (a) personal issues and (b) the ability to use the technology tools to address student needs. Personal concerns included teachers' technology self-efficacy as well as technology's ability to raise student achievement, highlighting a need for concerns-based PD with specific technology tools professional learning. PD also often needs differentiation and adjustment based on the student population taught by the participants (Donovan et al., 2007). It is critical to incorporate teacher voices in the PD process as well as maintain open channels of communication to offer them clear, ongoing information regarding innovative implementation, providing suggestions for the present study's intervention to involve community feedback channels as well as teacher voices in its creation (Donovan et al., 2007). Both elements contribute to overall teacher investment and support for PD initiatives. Although limited in scale and setting, the study's findings aligned with similar research (Lawless & Pellegrino, 2007;

Garet et al., 2001; Sparks, 2002) that noted the importance of making teacher concerns a focal point of PD, highlighting an area of focus for this study's intervention.

Building upon the idea of incorporating teacher voices, PD needs to address educators' practical needs and therefore involve a sustainable, trainee-centered approach to have a long-lasting impact (Yan & He, 2012). Similar to Donovan and colleagues' (2007) findings, an evaluation study of part-time inservice teacher PD programs in China of 95 secondary English educators discovered that pedagogical relevance to teachers' needs was a crucial variable impacting PD success and participants' opinions of PD. The study used reflective writing assignments analyzed through a reduction coding process to assess teachers' perceptions of inservice teacher training. Short duration of training emerged as a negative factor as it often led to short-term effectiveness. Additionally, the study highlighted that face-to-face PD successfully established that a CoP improves participants' perspectives of inservice PD, as participants believe it provides them invaluable lifelong learning experiences and increased general teaching self-efficacy, reinforcing the selection of a CoP as part of the study's intervention. PD program quality is a significant issue, which can improve and generate higher teacher support through longer duration, higher content relevance, more contact hours, increased practical course knowledge, and ongoing follow-up to promote autonomy (Yan & He, 2012).

Additionally, PD programs need to present quality practices and standards that are relevant to learning environments and aspects of learners (Hu et al., 2014), building a bridge between quality and teacher-centered concerns indicated by Yan and He (2012). Employing a mixed methods, fixed modeling approach, an investigation of 284 Chinese kindergarten teachers from 91 schools explored PD needs using self-reported questionnaires and expert observations (Hu et al., 2014). Through a comparison of specialist trainer observations and teachers self-reported questionnaires, the authors discovered teachers highly overrated their teaching quality, highlighting a gap between self-evaluation and actual practice. The authors maintained that PD needs to reflect high-quality, authentic practices to improve teacher quality by exposing participants to practical concepts and strategies, suggesting gaps in their knowledge and classroom strategies and identifying an area of focus for this study's intervention content. Additionally, educators need formative improvement feedback as well as ongoing follow-up to foster more profound insight into improved quality practices in authentic contexts. Although limited to a single province and therefore restricting the generalizability of results for the rest of China, Hu and colleagues (2014) assert ideas of authentic presentation indicated in other research literature (Bell et al., 2013; Donovan et al., 2007), which describe its benefits to the teacher learning process.

Face-to-face PD is a powerful tool to address deficiencies in teacher technology instructional skill, practices, and knowledge (Borko, 2004; Walker et al., 2012) as well as teacher technology self-efficacy (Shriner et al., 2010; Yan & He, 2012). It is essential to improve teacher skillsets that provide the foundation to increased student achievement (Borko, 2004; Darling-Hammond, 1999; Law et al., 2008; Li et al., 2012; Yoon et al., 2007). Teacher technology self-efficacy, technology instructional practices, and technology competency also represent focal areas for the intervention to address through the integration of teacher-focused concerns (Donovan et al., 2007; Hu et al., 2014; Yan & He, 2012) and authentic and applicable learning experiences (Bell et al., 2013; Donovan et al., 2007; Hu et al., 2014). The social interaction, sharing, and integration of teacher voices of face-to-face PD are critical components of social cognitive learning and development for teachers as well as the practical experience and contextually-based expertise in the activities in workshops. The ability of experts to assist and scaffold the learning of novices in this delivery format also represents ideas of situated learning theory regarding growth through collegial knowledge and expertise sharing. Although the logistical challenges of recruiting participants from multiple, geographical dispersed contexts prevent the use of face-to-face PD as an option, many of these benefits provide insight into the study's intervention. Notably, the social and interaction aspects of face-to-face PD, involving expert teachers working and assisting novices, reinforce the reasoning to couple the online PD selection with a CoP to avoid losing this critical social component. Additionally, insights from the literature (Donovan et al., 2007; Yan & He, 2012) regarding the integration of teacher voices and concerns in creating and shaping the PD process are vital for the creation of the intervention to align it successfully with teachers' practical needs in the classroom.

Blended professional development programs. Blended PD programs involve face-to-face and online components of teacher PD and are useful in raising the self-efficacy and competence of educators (Overbaugh & Lu, 2008). These programs often offer PD workshops that provide necessary subject-specific skills, followed by supplemental online learning courses to reinforce this initial learning (Watson, 2006). Due to its accessibility, blended PD is increasing in practice internationally as it provides positive gains to student achievement (Barbour, 2011; Dabner, Davis, & Zaka, 2012). Although also not selected as the modality for the intervention due to logistical concerns (e.g., availability of participants, geographic dispersion of participants), research related to blended PD programs offers insight as to the selection of PD as an intervention option with many of the advantages overlapping with the actual choice of online PD coupled with a CoP. The following section highlights that associated research.

Numerous mobile technology options can enhance traditional teaching and learning for staff, offering additional access options as well as ongoing collaboration through online mediums and reinforcing ideas of staff collaboration in the learning process. Shohel and Banks (2012) investigated the benefits of school-based technology-focused support in a Bangladeshi pre-intervention study of a blended PD international education pilot. The mixed methods study involved six administrators, 12 teachers, and 48 students in a school-based teachers' PD model involving an orientation workshop, a teacher's guide, an iPod with 12 learning modules, teacher meetings related to the program, as well as school visits and feedback sessions from program support staff. It collected data on inservice educators' needs regarding technology integration, particularly in contexts that required additional resources, using a questionnaire survey, classroom observations, and semi-structured interviews. Data were analyzed using grounded theory, which attempted to capture the message of the participants during the interviews. Appropriate mechanisms and incentives for teachers in their settings are important to improve classroom practices with technology. Student achievement is directly associated with increases in school expenditure, technology-enhanced educator PD, and improved context facilities. Authentic in-school and in-classroom support are necessary components to drive changes in teacher practices and abilities at a context level. School-based, technology-enhanced blended PD provides benefits to teachers in environments lacking resources (Shohel & Banks, 2012). This study provides insight for the intervention, suggesting the need for the PD content of the intervention to be accessible through mobile devices for ease of access for participants as well as ongoing collaboration in the CoP.

Additionally, blended PD leads to gains in teacher confidence with technology integration and use in the classroom as well as maintenance of those elevated levels over time, leading to long-term positive benefits for participating academic staff (Overbaugh & Lu, 2008). A mixed methods study of 377 K-12 educators participating in a blended PD program involved a

6-week online Public Broadcasting Service course and two additional 1-week, face-to-face immersion courses. The key program features included regular discussion board activities, special threaded discussions led by facilitators, virtual spaces for participants to share information, assignments, and a final project, all of which focused on improving self-efficacy related to technology integration. The study used a self-efficacy survey to collect data from participants at three stages (pre, post, and follow-up) and analyzed participants responses using stepwise multiple regression to identify demographic variables that predict self-efficacy followed by a one-way analysis of covariance to measure intervention effects. These data were triangulated with a semi-structured interview protocol focused on participants' perspectives on the program. Overbaugh and Lu (2008) revealed gains in technology competence and confidence of educators. Retention of these gains, however, lasted months after the conclusion of the program, highlighting the longitudinal benefits of PD delivered in a blended format with follow-up online modules. Blended PD also results in the teachers developing high self-efficacy using a variety of technology-enhanced instructional strategies relating to higher level thinking (Overbaugh & Lu, 2008). These findings help explain how the revised conceptual model (see Figure 3.1) represents a model of long-term teacher outcomes. Although these long-term results may not appear during the window of the intervention period, the framework establishes the relationship between initial PD and the short-term and intermediate outcomes of teacher development.

Blended PD also provides positive long-term growth of teacher technology self-efficacy, maintaining increases in confidence over multiple years (Watson, 2006). Watson's study involved 96 participants in the West Virginia K-12 RuralNet Project, which investigated blended PD workshops on technology integration lasting five days and the impact of optional follow-up, support in the form of online course review modules after the initial program. Program activities involved using and integrating the Internet in the classroom with an emphasis on effective email use, web searches, downloading, and implementing web-based activities with students. Watson employed a teaching efficacy beliefs survey before and after the program, which was also used a third time with participants six years after the original workshop. The blended PD program offered an ongoing impact on teacher technology confidence with using the Internet to enhance classroom practices. Despite analyzing a PD program administered in the late 1990s through a self-reporting survey, the study offered insight into how educators can sustain initial self-efficacy gains in PD technology workshops through an online medium, adding insight to the possible long-term development of the intervention and aligning with development ideas in the revised conceptual model (see Figure 3.1). Ongoing support through supplemental online courses is essential to maintain benefits garnered from PD workshops and help teachers effectively apply their knowledge in the classroom (Watson, 2006).

Further, blended PD communities improve teaching skills and teacher knowledge of their subjects, particularly when embedded within an offline social network of educators (Matzat, 2013). A large-scale quantitative investigation of 26 online communities of 1,492 Dutch secondary teachers compared a blended model of PD with a pure virtual approach using an online questionnaire evaluated through multivariate analyses. Program components included discussion groups, activities, readings, and sharing material related to general teaching strategies. Teachers participating in both PD models benefitted from sharing educational content as well as the collegial participation in discussion topics, which involved social interaction activities. The need for increased active interaction in discussion groups, however, was an issue with online communities, a key consideration for the intervention. Additionally, trust issues arising from anonymity developed among participants in the online group (Matzat, 2013). Regardless of these drawbacks, an online PD model provides general benefits to participating educators with a blended model increasing those positive effects (Matzat, 2013). A complete online and offline integration of PD workshop elements, however, is not necessary to achieve teacher development, and scaling online learning is a more feasible option of PD for teachers (Matzat, 2013).

Although the blended model of learning demonstrates promise for teacher PD (Matzat, 2013), further research is necessary regarding beneficial online tasks for participants, the role of online facilitators, and the transfer of effect to student achievement (Owston, Sinclair, & Wideman, 2008). A mixed methods study of two 1-year blended PD programs for Canadian middle school educators called the Teacher eLearning Project followed teacher development through one initial face-to-face session followed by an 8-week online learning program. Session content included topics related to Ontario mathematics standards (e.g., number sense, geometry, algebra, probability) with face-to-face workshops employing hands-on, small group activities and online modules focused on a weekly theme and related articles, videos, interaction programs, worksheets, discussion, reflection journals, moderated chats, and assignments. One group of participants included 68 mathematics educators, and the other involved 65 science and technology teachers with pretest and posttest data collected through surveys, classroom observations, and participant interviews. Owston and colleagues (2008) evaluated program impact using Guskey’s (2000) five-level evaluation framework, which includes teachers’ attitudes and knowledge, school support, transformation in teaching practices, and student views and learning of the material. The blended PD program positively impacted teacher attitudes and content expertise, and it encouraged many to transform instructional practices based on the PD instruction, aligning with the long-term teacher development noted in the revised conceptual framework (see Figure 3.1). The transfer of benefits to students in the study, however, was mixed with only those students of the educators in the science and technology program viewing instruction and learning in the subjects more positively. Further studies are necessary to explore the advantages of blended PD and how it relates initial PD to eventual student improvement outcomes before adoption on a large scale (Owston et al., 2008).

Not all PD programs, however, positively impact teacher attitudes and perceptions toward technology integration and usage (Uslu & Bumen, 2012). A quantitative study involving 56 Turkish participants in the 90-hour, 5-week Intel Teach Program employed surveys to collect data before, after, and six weeks after the program. Participants engaged in seven days of face-to-face training in the computer lab, focusing on basic computer skills such as email usage, file sharing, presentation skills, and blogs, with 13 days of distance learning as well, concentrated on assignments and project work. The authors analyzed the impact of technology-focused PD on teacher attitudes, technology use in the classroom and for lesson preparation, encouragement of students to use technology, and the influence of using technology with students between the three different collection points using univariate ANOVA. The PD program increased teachers' classroom technology use, technology use for lesson preparation, and encouragement for students to use technology. It also influenced teachers to use technology more often with students. Attitudes toward technology in education, however, decreased during the pre- and post-test phases of the project. Despite this finding, the PD program's positive impact on technology integration remained six weeks after its completion based on a retention analysis of 41 participants. Qualitative evaluation involving teacher voices, however, would have been beneficial to uncover the reason behind attitude decreases of participants during the intervention.

Additionally, blended PD is not necessarily sufficient to maintain teacher engagement in the learning process (Henderson, 2007). A longitudinal multiple-case study of two groups of teachers, five from Australia and four from the United Kingdom, evaluated teacher participation in an introductory face-to-face PD program followed up by an online learning component. Coursework focused on cultivating CoP cohesion with one face-to-face training day devoted to the use of technical software. The 4-week online component involved both individual and collaborative tasks to foster a sense of community engagement through dialogue, creation of personal pages, and participation in social discussion forums. Henderson collected data regarding engagement from surveys, review of online activities, discussion forums and e-mails, and semi-structured interviews. The first group maintained involvement through a CoP. The second group involved a facilitator, who acted as a community organizer and supported engagement and inclusion through regular contact between local and international participants. Regardless of this difference, both highlighted the essential nature of a CoP combined with a blended PD delivery to reach the highest level of engagement and result in the most benefits for participants. Sustained PD over time is essential to afford a transformative learning experience. Through the motivation of a community environment, participants feel more compelled to participate and accountable in the learning process. The study provided guidance to the present study's intervention regarding the benefits of combining a form of PD delivery with a CoP to heighten participant motivation and engagement and also offer teacher development benefits.

By combining traditional face-to-face PD approaches with online learning, blended PD provides compelling benefits to educators (Matzat, 2013; Overbaugh & Lu, 2008; Watson, 2006), which can then transfer into student achievement (Barbour, 2011; Dabner et al., 2012; Owston et al., 2008). Blended PD, however, needs further investigation regarding specific content to provide universal student gains (Owston et al., 2008) and a stronger community focus to raise engagement (Henderson, 2007), which can potentially be provided by a CoP. The strong feasibility of scaling online PD learning (Matzat, 2013) offers necessary guidance on the delivery format of the intervention PD program as it suggests a feasible manner to reach geographically dispersed participants in an on-demand, just-in-time method, allowing asynchronous access to teachers with heavy workloads. Additionally, research data on the importance of ongoing community engagement through social dialogue in PD (Henderson, 2007; Matzat, 2013) as well as the need to focus on the core online tasks related to professional learning (Owston et al., 2008) highlighted areas for me to focus on regarding the development and implementation of the study's intervention.

Online professional development programs. Online teacher PD programs are web-based and asynchronous programs that represent efficient and productive options to replace traditional face-to-face PD programs. These programs provide a cost-effective solution, which is especially important within contexts under economic constraint (Shaha, Glassett, Copas, & Ellsworth, 2015). Online learning that supports teachers should be thought of as an innovative approach that offers the opportunity for collaborative inquiry and is specifically designed to overcome logistical challenges in the instructional process (Lock, 2006).

Teachers participating in online PD programs demonstrate significant student achievement increases compared to non-participating peers (Shaha et al., 2015). A quasi-experimental study involving 422 Title I schools in 26 states in the United States investigated whether schools in a treatment group receiving an online PD teacher education program experienced gains over their peers in the control group. The PD program involved educators receiving access to PD 360 and Observation 360 through the School Improvement Network in

Salt Lake City at a minimum of 90 percent of teachers in a school with an average of 90 minutes per participating educator. The teachers engaged in a range of activities, including viewing instructional teaching strategy videos, participating in community discussions, and downloading additional PD material. Data analysis included a comparison of two consecutive school years of student performance data from classes of participating teachers. Student performance in reading and mathematics significantly increased in schools with educators participating in the online learning program compared to counterparts in the control group. Online, readily accessible PD is a valuable resource for student development. This form of PD needs to be expanded and provided to as many schools and educators as possible to transfer the benefits to student achievement due to the ease of scalability to reach a broad audience of educators (Matzat, 2013; Shaha et al., 2015).

Online PD, however, can provide challenges to the learning process for participants regarding delivery and satisfaction, particularly in a cross-border delivery framework (Jayatilleke, Kulasekara, Kumarasinha, & Gunawardena, 2017). A qualitative study investigated a cross-border PD program from the Open University of Sri Lanka for participants in Pakistan (n = 9), Mauritius (n = 10), and Sri Lanka (n = 11) to train online tutors and mentors. The online course involved teachers participating in 14 modules on Moodle, which included learning activities and assignments, reflection journals, discussions, quizzes, peer evaluations, as well as online simulations. Three academics from the Open University of Sri Lanka as well as four e-mentors from the United States facilitated the courses over six weeks. Jayatilleke and colleagues (2017) described several needs for participants as well as facilitators based on data from reflections and informal, anecdotal records from program administrators and information from self-reflection instruments (pre, mid, and post), and journal reflections from teachers. Meticulous organizational structure of an online PD course, alternative plans to overcome technical challenges, adequate workload, linear structure, and a comprehensive orientation program are all vital elements needed for any online PD program, specifically cross-border programs (Jayatilleke et al., 2017). These components may lead to effective participant development as increased satisfaction can lead to improved engagement and therefore enhanced learning (Jayatilleke et al., 2017). These elements also provide fundamental guidance for the creation of the intervention PD program for the present study, offering a list of approaches to overcome primary implementation issues.

Despite these potential setbacks, when online PD is structured and supported correctly, it can lead to teacher knowledge growth, which can result in positive student outcomes (Reeves & Pedulla, 2013). A correlational study by Reeves and Pedulla (2013) of an online PD program (*n* = 1,231) investigated online PD predictors of impact associated with teacher knowledge, instructional practices, and student achievement through a secondary analysis of data from e-Learning for Educators (EfE) Initiative. EfE courses, which are fully online and asynchronous, have been delivered over the past five years in 10 states. The programs are approximately six to seven weeks in length and include readings, activities such as viewing videos and doing assignments, and facilitated discussions. The study employed surveys to collect data from participants before, after, and six months to one year after the program, using separate blockwise ordinary least squares regression analyses to explain variance in each key construct. Teacher technology competency, school support, and coherence of the program directly influenced participant teachers' knowledge growth in the online PD program. In turn, teacher knowledge gained from a useful PD course related to the improvement of instructional strategies leading to increased student growth. These relationships represent the fundamental backbone of the revised conceptual model (see Figure 3.1), highlighting the key associations of the various variables related to teacher and student development. Additionally, online PD courses with practical, context-relevant content with high-quality readings that are transferable to the classroom result in more significant teacher learning (Reeves & Pedulla, 2013). High-quality online PD can help address various issues of teacher PD and goals for student achievement (Matzat, 2013; Reeves & Pedulla, 2013; Shaha et al., 2015)

Although Jayatilleke et al. (2017) maintained the need for a linear structure in online PD, an individual learning pathway design is also a useful format for online technology PD for teachers (Prestridge & Tondeur, 2015). A qualitative analysis of 12 Australian primary teachers from four schools used an Action Research methodology in a year-long PD program, involving four stages (i.e., plan prospective to action, action prospective guidance from planning, observation prospective for reflection, and reflective prospective on observation). The PD program involved participants teachers engaging in a mini research project, which involved planning, implementation, and analysis. The authors included technology integration as a core element of the learning aspect of the training program. Data collection involved screen captures of online discussion forums and teachers' blogs as well as a review of teachers' curriculum materials, planning documents, emails, and final interviews, all of which the authors analyzed through an interpretive process of organizing, categorizing, and coding data. Prestridge and Tondeur (2015) identified three themes related to online PD: investigation, reflection, and constructive dialogue. These three ideas highlighted engagement methods necessary to produce beneficial learning results. Additional principal elements of online PD included cultivating an individual and group online community as well as learning supported through expert mentorship, an area discussed in a later section as essential to this study's intervention. Online PD that addresses self-efficacy related to technology is vital for teachers to implement innovations in the classroom (Prestridge & Tondeur, 2015).

Despite online PD and professional learning communities being able to achieve similar goals to traditional PD models, further research is necessary for clear delineations between these approaches (Blitz, 2013). Motivation to interact with peers, for example, is lower in online PD when compared to traditional face-to-face methods (Blitz, 2013). In a report prepared for the Institute of Education Sciences of the U.S. Department of Education related to online versus conventional professional learning communities, flexibility was a significant benefit to the online PD approach. As indicated by Prestridge and Tondeur (2015), online PD programs foster self-reflection better than traditional models (Blitz, 2013). Both methods provide equal benefits regarding teacher knowledge development. Online professional learning communities and PD, however, offer additional advantages over traditional models, including time and space for collaboration, lower cost, the opportunity for individual learning pathways, opportunities to scale participant interactions, comprehensive access to resources and tools, and ongoing professional mentoring. Each of these advantages represents an area of guidance for developing the study's intervention, particularly scaling participant interactions and providing access to an extensive database of resources. A blended model involving both online and face-to-face components may be the best approach to teacher learning and education, considering the benefits of both methods (Blitz, 2013).

Although Blitz (2013) maintained blended PD was the best approach to teacher education, both traditional face-to-face and online PD programs provide positive benefits with no significant difference in impact (Fishman et al., 2013; Russell, Carey, Kleiman, & Venable, 2009). A randomized cluster trial investigated both modalities focusing on a 6-day, 48-hour traditional workshop with 24 participants and a 2-day, 12-hour online PD program with 25 teachers of environmental science (Fishman et al., 2013). For the traditional workshops, all teachers gathered for full-day seminars focused on hands-on and other practical activities to prepare teachers to implement an environmental science curriculum. Although the online program had the same objective, it focused on engaging participants in short courses, involving facilitator guided questions, online assignments, and written reflections. Pretests and posttests assessed teacher content knowledge, self-efficacy, feelings of preparedness to teach, and general beliefs about teaching, and student content knowledge, which the authors analyzed using multivariate analyses and linear regression models of teacher characteristics. Fishman and colleagues also reviewed videos of classroom practice, which were triangulated with the survey data to determine the differences between the two delivery methods. The study uncovered comparable findings to Prestridge and Tondeur (2015). Although educators in both approaches improved content knowledge and personal beliefs regarding the subject, neither modality emerged as providing stronger benefits. Additionally, the students of participating educators showed no difference in achievement gains between the two different PD methods. Regardless of delivery method, the benefits of PD for students and teachers are equal, suggesting program designers should consider the use of both approaches depending on the learning objectives (Fishman et al., 2013).

Similar to the comparative study of Fishman and colleagues (2015), a study by Russell and colleagues (2009) of 150 elementary mathematics educators compared an 8-week face-to-face PD program and an online PD program with similar content and instructors. The program employed was the Building a Systems of Tens course, which engaged participants in reading articles, classroom mathematics activities, discussions, and assignments. The content of both delivery methods of PD was the same, but the online course followed a weekly schedule, in which participants needed to complete approximately three hours of online activities and interactive discussions with peers. The authors employed six instruments for data collection, including a demographic survey, a pedagogical beliefs and practices survey, a measure of teachers' knowledge of teaching the base ten number system, a student survey, a teacher informational log of classroom practices, and a program evaluation. The study discovered the positive outcomes were comparable between the two different modalities of delivery. Both programs impacted teachers' instructional strategies and mathematical knowledge with no statistically significant effect on pedagogical beliefs. Teachers in the online program, however, expressed higher interest in future engagement in similar PD online than those educators in the face-to-face model, describing a more favorable opinion of it than previous face-to-face learning experiences. This satisfaction component suggests an online PD intervention program may generate higher engagement and motivation in a participant sample of teachers, alleviating potential issues of attrition (Russell et al., 2009).

Overall, online PD provides learning gains to educators (Reeves & Pedulla, 2013; Shaha et al., 2015) that rival that of traditional face-to-face PD models (Fishman et al., 2015; Prestridge & Tondeur, 2015; Russell et al., 2009) and lead to student achievement (Reeves & Pedulla, 2013; Shaha et al., 2015). As the model can be offered comprehensively to a vast number of contexts at a low investment cost, the delivery format requires further research for broader application to address educator PD needs (Matzat, 2013; Shaha et al., 2015). Additionally, the ability for online PD to generate higher participant engagement and motivation than face-to-face models (Keller, 1987; Russell et al., 2009) offers guidance on how to maintain high participant retention for the intervention. The positive benefits of social interaction and shared cognitive learning in online PD (Matzat, 2013; Hu et al., 2014; Yan & He, 2012) inform the intervention regarding the need for a social sharing component. This social interaction component and collegial sharing of knowledge is a critical element of CoPs, which was employed in the present study's intervention to enhance the selected online PD format. Considering these advantages as well as the potential reach of an online PD approach, I chose it as the core model of professional learning in the intervention in tandem with a CoP, which as described in the next section includes a social interaction component and collegial sharing of knowledge to enhance the selected online PD format. I selected online PD as the core modality for the intervention as it offers the fundamental benefits of other PD formats and represents an option that could overcome some of the logistical challenges faced within the study. These challenges included recruitment of participants from geographically dispersed contexts, working around the availability of participant schedules, and financial constraints related to renting a space for potential face-to-face workshops. Additionally, the online PD option coupled specifically with a CoP aligned with the increased cultural shift in China toward the use of mobile technology in all aspects of professional life and the rise of the dominant social communication app WeChat, which most workplaces already employ as a professional communication tool.

Communities of practice. A CoP, a term first defined by Lave and Wenger (1991), involves a group of individuals in a similar field sharing a common interest for an activity they all know and want to learn how to improve (Wenger, 1998). It involves the mutual engagement of individuals in a collaborative endeavor and often practices emerge from the shared experience (Eckert & McConnell, 1992). Four tenets defining a CoP include that learning occurs as part of (a) practice, (b) being a knowledgeable member of the shared community, (c) a meaningful experience, and (d) identity develops because of being part of the community (Wenger, 1998). In this present study, a CoP refers to an ongoing, collaborative PD approach in which individuals share knowledge, ideas, practices, strategies, etc., specifically related to technology integration, to develop a shared awareness and experience regarding best practice (MacDonald, 2008).

Establishing a CoP helps teachers enhance their instructional and pedagogical practices through the communication of knowledge (Kim & Cavas, 2013; Lock, 2006; Snow-Gerono, 2005). CoPs are practical approaches to PD as they are ongoing, needs-focused, collaborative environments of knowledge sharing that improve teacher identification and implementation of instructional practices (MacDonald, 2008; Vavasseur & Kim MacGregor, 2008). By identifying a CoP, aligning it with teacher goals, and embracing a research approach, PD can improve teacher reflection, raise staff satisfaction, and increase student learning (MacDonald, 2008). Learning community growth and technology integration support and influence one another through a beneficial and reciprocal relationship (Williams et al., 2008). CoPs represent shared enterprise communities, often with a set of culture-specific practices in which members interact and produce new meanings through negotiations on content-specific practices (Bahng & Lee, 2017). As Henderson (2007) previously described, a CoP combined with another PD delivery can reach higher levels of ongoing engagement for participants and therefore provide more powerful benefits for participants.

A CoP defines itself along critical dimensions and moves through various stages of development during its existence (Wenger, 1998). In a seminal article, Wenger (1998) highlighted three key aspects that help identify a CoP. CoPs work to (a) establish a joint enterprise, which is both understood and continually evolved by its members. The (b) mutual engagement of a CoP connects members as a single social entity, and through this collegial engagement, CoPs (c) produce a shared repertoire and inventory of shared resources, which participants can add to over time and continue to develop. Additionally, CoPs move through five different stages of development based on the interaction of their members. These include the potential stage, which is when individuals encounter a shared problem without the benefit of shared practice and are discovering commonalities. The coalescing stage involves potential members coming together as a group to understand their shared potential and negotiating the joint enterprise of their new community. In the active stage, which is the pinnacle of interaction, CoP members share and develop practices and knowledge, creating artifacts, relationships, renewed interest, and commitment. The dispersed stage still involves communication among members but to a lesser degree with only occasional dialogue regarding advice. Finally, in the memorable stage the CoP no longer exists, but members view it as a positive experience in the creation of their identity and still may employ artifacts and ideas from it. Though each CoP usually passes through this final stage, it is the engagement of the members that determines its longevity (Wenger, 1998).

A CoP is held together by the community's passion, commitment, and identification of the group's area of expertise (Wenger & Snyder, 2000). In an article for *Harvard Business Review*, Wenger and Snyder (2000) highlighted the benefits of CoPs, noting they solve problems quickly, transfer best practices, develop professional skills, help cultivate and retain talent, start new lines of inquiry and thinking, and help drive strategy. CoPs can last as long as interest is maintained by participants, consistently adapting to innovations and changes in a particular field (Wenger & Synder, 2000). The authors described CoPs as "the hidden fountainhead of knowledge development and therefore the key to the challenge of the knowledge economy" (Wenger & Synder, 2000, p. 145). As a new frontier, CoPs represent a learning ground for developing educators to help them foster 21st century skills in their students. Additionally, the informal setup of CoPs requires specific administrator guidance to fully leverage their potential (Wenger & Synder, 2000).

Although administrator guidance is important, multiple other aspects of CoP designs are necessary to realize the full benefits of the learning approach for educators. Curwood (2013) from the University of Sydney conducted a yearlong ethnographic case study investigating the application of a design framework to a technology-focused community of learning of five high school English teachers in the United States. A design-based framework involves highlighting the importance of the ordinarily implicit aspects of the design of a program to create new theories, artifacts, and practices to impact learning and teaching strategies. Participants in the community met once during the summer and bi-monthly over the school year to discuss and share technology integration strategies. The study focused on the benefits of technology toward student development and explored research questions focused on the methods used to promote technology integration and program outcomes. It involved the analysis of an initial teacher survey, interviews, recordings of meetings, observational field notes, teacher-written reflections, and various teacher artifacts. Advantageous aspects of the program's framework included the mission statement, hands-on learning with digital tools, ongoing critical discourse, frequent interaction, and the need to continually interact and focus on student work. A design framework can provide a common foundation for the creation, integration, and review of teacher PD mainly related to technology and learning communities, as well as distributed cognition (Curwood, 2013).

Cultivating communities of practice appropriately can be a driver for organizational success (Wenger, McDermott, & Snyder, 2002). Although Curwood (2003) attempted to highlight important design components of a CoP, Wenger and colleagues (2002) maintained seven principles that generate a sense of aliveness in a learning community. CoPs need to be (a) designed for evolution so they can change as the needs of participants change. A CoP should (b) maintain an open dialogue between members that involves inside and outside perspectives as well as (c) invites different levels of participation. Additionally, CoPs should (d) develop public and private spaces for discourse and (e) focus on learning value. Through a (f) combination of familiarity and excitement, they should (g) create a communal rhythm of sharing and participation. Due to the voluntary nature of CoPs, success depends on their ability to maintain excitement, relevance, and value for members, suggesting the importance of the seven principles that foster a sense of “aliveness” (Wenger et al., 2002, p. 50).

As channels of ongoing discourse, online CoPs present a school the opportunity to connect teacher colleagues with their principal as well as augment opportunities to discuss and share instructional ideas (Vavasseur & Kim MacGregor, 2008). A mixed methods comparative case study investigation of a content-centric PD online CoP for middle school teachers and principals in two schools in the United States revealed participating academic staff increased curriculum-based knowledge as well as collaboration with colleagues across academic units. Participants engaged in online communities on Blackboard, which involved weekly discussions about topics related to technology integration based on specific prompts pertaining to teachers’ beliefs about teaching and learning. Vavasseur and MacGregor triangulated two sources of quantitative data, a teacher efficacy survey and teacher performance data, with two sources of qualitative data, focus group interviews and online discussion artifacts. Teachers gained self-efficacy associated with technology integration in instruction through practice as well as through collective efficacy growth effects. Integral characteristics of a successful CoP include use of a needs assessment, principal involvement and introduction of the experience, high-quality facilitation of ongoing dialogues, and effective online communication (Vavasseur & Kim MacGregor, 2008). Administrator selection of teacher teams, flexibility, and needs-relevant content are also vital components (Vavasseur & Kim MacGregor, 2008), highlighting the importance of the association between school leadership and PD (Chang, 2012; Machado & Chung, 2015; Kurland et al., 2010).

Even without the presence of administrative guidance, the differing levels of expertise and the diversity of perspectives of online communities allow participants to co-construct new information, knowledge, practice, thinking, and understanding for application in the classroom (Booth & Kellogg, 2015), which is similar to ideas maintained by Vavasseur and Kim MacGregor (2008). A qualitative value-creation analysis of online communities over six months including 25 educators from four different CoP revealed a keen sense of community closely relates to the value of the learning approach (Booth & Kellogg, 2015). Participants in the community were included based on their ongoing, voluntary engagement and participation in communal discussions and activities of professional learning, which were not part of a structured or credited course. The study assessed the value of the communities through coding semi-structured interviews using Wenger, Tayner, and de Laat's (2011) framework for evaluating value creation in online CoPs. Structured learning activities and discussions offer the ability for high-value, ongoing engagement. The creation of tangible artifacts, such as documents, ideas, strategies, etc., paired with leadership opportunities, resource inventories, and tool offerings, heighten the value of the learning experience for teachers (Booth & Kellogg, 2015). Though a small sample, the study presented valuable findings comparable in future studies as well as relevant guidance for the creation of a PD program with a CoP regarding the need to have participants create artifacts working with a resource and tool database.

The implementation of a CoP framework in an intervention can encourage novices to learn through discovery, problem solving, and accidental learning (Bahng & Lee, 2017). An inside-led, work-embedded study employing grounded theory approach involved 229 elementary teacher candidates in a science course to investigate their 3-year learning journey through a virtual reality platform. Participants in the communities engaged in three types of activities: (a) VR activities, (b) science lesson planning activities, and (c) peer teaching activities. These activities were in addition to their engagement with the general social dialogue of the CoP. Bahng and Lee (2017) integrated the grounded theory approach to analyze the social concepts, patterns, and structures of the platform through the process of constant comparative methods, using reflective questionnaires, teacher journals, lesson plans, peer observations, and instructor's notebooks. The study integrated a theoretical framework involving Wenger's (1998) CoPs as well as Wells' (2000) dialogic inquiry based on the idea that learning requires practice and participation within a shared community. Three groups emerged regarding the teachers' perceptions of integrating VR into their classroom practices, including skeptical integrators (29%), observant integrators (59%), and innovative integrators (12%). The teachers, however, did not translate their virtual reality platform learning experience to their students. Although teachers benefit from a collaborative community of inquiry-based learning, there is sometimes a disparity between learning experiences of teachers in PD and practices that are implemented later with their students in the classroom (Bahng & Lee, 2017). The study's implementation of a collaborative CoP as part of the teacher learning process offered a model for the present study's intervention as well as guidance to integrate specific activities to bridge the gap between the teacher's learning experiences and practice.

Further research needs to explore the benefits of CoPs delivered in connection with other PD formats for educators (Smith, Hayes, & Shea, 2017). A metanalysis of empirical literature grounded in Wenger's (1998) CoP framework from 2000 to 2014 revealed that the majority of studies currently focus on verifying the fundamental elements of CoPs, including collegial enterprise, collaborative engagement, and shared dialogue. Smith and colleagues highlighted the need for research to move beyond traditional theory verification and explore more complex understandings of CoPs influencing online and blended learning. Research needs to examine CoP formation as well as the impact of CoPs on professional identity development over time. Additionally, CoPs need to help learners understand how to participate in a meaningful manner as well as how to effectively mediate the engagement of participants (Smith et al., 2017). The metanalysis highlighted areas of potential new exploration for the present study's intervention as well as the need for participant roadmaps for participation to ensure high engagement.

CoPs are practical solutions to support professional learning, improving teacher knowledge and practices through collegial sharing and reflection (Kim & Cavas, 2013; Lock, 2006; MacDonald, 2008; Snow-Gerono, 2005; Vavasseur & Kim MacGregor, 2008) and creating a more engaging learning experience for educators by connecting experts and novices in the same learning environment (Booth & Kellogg, 2015; Vavasseur & Kim MacGregor, 2008). The possibility of a readily accessible online CoP offers the ability for real-time support for teachers as well as the sharing of the latest education strategies (Booth & Kellogg, 2015; Vavasseur & Kim MacGregor, 2008), employing aspects of social interaction to improve learning and development as noted in the dual theoretical framework. Considering these aspects, a CoP needs further investigation within a Chinese learning community as a potential option to provide just-in-time, sustained teacher support to a mixed ability group of educators, especially if the intervention employs the popular Chinese social media platform WeChat. As a result, I selected it as a supportive PD delivery format for the present study along with a core online PD program with both combining different advantageous elements, which could be beneficial in a Chinese educational context.

Summary

This study focuses on technology integration among educators in the context of China. From the literature, several constructs emerged that point toward potential interventions requiring further investigation that drive the present study. These elements included teacher technology self-efficacy (Cheung, 2008; Li et al., 2012; Long et al., 2013), preservice training opportunities (Cheung, 2008; Sang et al., 2012; Zhou et al., 2011), teacher technology proficiency (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007), teacher technology integration in instructional practices (An & Reigeluth, 2014; Becker, 1994; Brush & Saye, 2009; Ertmer, 2005; Russell et al., 2003), and inservice PD opportunities (Dai et al., 2011; Zhan, 2008). This chapter consisted of a review of the intervention literature on the identified research topic. The examination focused on the research conducted by previous researchers and included discussions on themes arising from the literature on PD programs, their different delivery methods and components, as well as their benefits. The review consisted of three main sections.

First, I reviewed literature associated with the theoretical framework for the study, which included social cognitive theory and situated learning theory. I highlighted that social cognitive theory, developed by Bandura (1977b, 1986), maintained that behavior is learned from the environment through observational learning, which requires cognitive processing. For the present study, social cognitive theory provided a lens on high-quality, effective PD, which involves authentic learning experiences in which learners are active participants in their education process and need to monitor their cognitive process and development while observing others and interacting with the environment (Desimone & Garet, 2015; Hu et al., 2014). Additionally, I described how situated learning theory focused on the interdependent relationship between the individual and the world associated with the process of learning, cognition, and understanding and emphasized the social phenomenon of meaning and knowing through participation in communal activity, practice, and thought (Lave, 1991). For the present study, situated learning theory provided a foundation for the relationship between PD and CoPs, offering guidance regarding positive social interactions between educators and how they can improve their learning through peer interactions and knowledge sharing (Kearney, 2015; Lave & Wegner, 1991).

Next, I examined a broad overview of the intervention literature related to PD and its key components, in which I discussed an overview of PD as an intervention. I maintained that as an intervention PD programs offer educators the opportunity to enhance the skills necessary to address student needs in the classroom (Garet et al., 2001; Guskey, 2002; Lawless & Pellegrino, 2007; Loucks-Horsley et al., 1996; Wilson & Berne, 1999). I also discussed the critical components of PD. A synthesis of seminal PD literature (Darling-Hammond et al., 2017; Desimone, 2009; Loucks-Horsley et al., 1996) highlighted the following components: (a) proper duration, (b) adequate workload with a linear structure, (c) learner-centered focus, (d) inclusion of teacher concerns and voices, (e) engagement through actively experiencing technology tools, (f) collaborative environment, and (g) long-term, sustained support and teacher self-efficacy. All of these elements, excluding long-term follow-up support, are included in the study's online PD and CoP intervention.

In the final section, I discussed the different major PD delivery formats, highlighting the key associated benefits of each method, and justified the selection of online PD with a CoP as the intervention. A review of PD literature analyzed typical, traditional face-to-face (Martin et al., 2010; Walker et al., 2012), blended (Overbaugh & Lu, 2008; Watson, 2006), online (Prestridge & Tondeur, 2015; Reeves & Pedulla, 2013; Shaha et al., 2015), and CoP (Booth & Kellogg, 2015; Smith et al., 2017; Vavasseur & Kim MacGregor, 2008; Wenger, 1998) PD models with benefits attributed to all approaches of delivery for teacher development as well as student achievement. An online PD program format coupled with a CoP was selected for the present study because I determined that this approach requires further investigation within a Chinese learning community as a potential option to provide just-in-time, sustained teacher support to a mixed ability group of educators. Additionally, it represented the only realistic option that could overcome the logistical challenge of recruitment of participants from multiple, geographically dispersed contexts, allowing for the PD to be easily accessible to all participants.

Through the analysis of each of these delivery methods, the beneficial nature of PD relative to teacher improvement is clear as a solution to addressing the problem of practice noted in the present study. The revised conceptual model (see Figure 3.1) suggests a PD approach will provide the most beneficial impact to teachers, both in the short- and long-term. High-quality PD can address teacher technology self-efficacy (Martin et al., 2010; Vavasseur & Kim MacGregor, 2008), teacher technology competency (Brinkerhoff, 2006; Reeves & Pedulla, 2013; Shriner et al., 2010), technology integration in instructional practices (Martin et al., 2010; Shriner et al., 2010), and teacher knowledge of 21st century skills when appropriately designed. Although limited research exists explicitly reviewing teacher knowledge of 21st century skills, the literature highlights how PD can address teacher knowledge and beliefs (Chikasandra et al., 2013; Fishman et al., 2013; Li et al., 2012; Liu & Feng, 2015; Martin et al., 2010; Russell et al., 2009).

If the vision of a school is to provide their students with a pathway toward becoming global citizens, it is essential to explore how the students can be better supported through technology to improve the construction of knowledge and develop 21st century skillsets. A review of the intervention literature and an analysis of the unique challenges of a Chinese locale in the previous literature review and needs assessment highlight high-quality PD as a compelling and practical intervention. The primary constructs and their networked relationships require a thorough investigation to result in better classroom practices and provide the needed support to teachers to adopt technology in instruction. Through attention to these factors, a school context can move toward encouraging its educators to improve student achievement and 21st century skills using technology. At the root of this issue, effective PD is critical to address the intertwined network of variables.

Therefore, this study implemented an online, ongoing, technology-related PD program with a CoP. This dual approach will offer the most potential for the development of technology self-efficacy as well as improvements in technology competency and increased use of technology instructional practices across multiple contexts. It will also mitigate the obstacles and disadvantages faced by some of the other potential solutions. A PD program supported by the instructional guidance of a teacher technology committee offers the strengths of being content-centric, culturally relevant and sensitive, as well as feasible and executable. It can also address the effective PD components highlighted amongst a synthesis of PD studies, notably proper duration (Davidson et al., 2009; Yoon et al., 2007), a learner-centered focus on classroom-related content (Desimone & Garet, 2015; Shriner et al., 2010; Vavasseur & Kim MacGregor, 2008), engagement through actively experiencing technology tools (Curwood, 2013; Desimone & Garet, 2015; Hu et al., 2014; Martin et al., 2010; Shohel & Banks, 2012), a collaborative environment (Lock, 2006; Swan & Dixon, 2006), and long-term, sustained support (Claesgens et al., 2013; Henderson, 2007; Watson, 2006) through an established CoP (MacDonald, 2008; Vavasseur & Kim MacGregor, 2008; Wells, 2007). Additionally, it also accounts for several highlighted logistical components, including strong organizational structure, alternative plans and strategies to overcome technical challenges when they arise (i.e., different approaches to instruction and additional variations of activities), adequate workload, linear structure, and a comprehensive orientation program (Jayatilleke et al., 2017) as well as the inclusion of teacher concerns and voices (Donovan et al., 2007; Hu et al., 2014; Yan & He, 2012). When delivered in an efficient, well-planned, reoccurring, and high-quality approach with follow-up, PD allows educators to be more successful in fostering student achievement (Borko, 2004; Darling-Hammond, 1999; Garet et al., 2001; Law et al., 2008; Lawless & Pellegrino, 2007; Li et al., 2012), and an online PD program with a CoP component has the potential to have a powerful impact in a Chinese context.

Chapter Four

Intervention Design: Method and Procedure

One mechanism for beginning to address the challenge of guiding students to develop necessary 21st century skills supported through the integration of technology is to first improve teacher technology self-efficacy, competency, and integration practices as well as teacher knowledge of 21st century skills. For the present study, the intervention involved the implementation of an online, cross-curricular, technology-related PD program with a CoP to address this issue. As described in the intervention literature review, PD can improve student learning and achievement by raising teacher quality and improving teacher performance. Based on the research and needs assessment findings, the intervention aimed to introduce a multi-session PD and CoP that encouraged the development of teachers through the implementation of activities that target the four areas of need. Well-designed, effective PD is necessary to impact the variables, providing the most benefits to educators across multiple contexts and avoiding the barriers and disadvantages faced by some of the other potential solutions.

Purpose of the Study

The purpose of this study was to examine the effect of an online PD and CoP program to improve K-6 educators' abilities to implement instructional practices that potentially foster students' 21st century skillsets. To do this, a PD program was proposed to affect teachers' self-efficacy, technology competency, technology integration in instruction, and fundamental knowledge of necessary 21st century skills for students. The research study tested the hypothesis that teachers who participate in the intervention will report changes in these four primary areas. Further, it is theorized that these teacher changes will lead to improved student engagement, growth of student technical skills, enhanced use of 21st century skills, and eventually lead to increased student achievement as a long-term outcome (see Figure 3.1). The research questions for this study included both process and outcome questions.

Process Research Questions:

RQ1: How do participants describe their context relative to support for technology integration to support 21st century learning?

RQ2: What was the enacted PD and CoP program and to what extent was it implemented with fidelity?

RQ3: What were the participants' experiences within the online PD and CoP program?

RQ3a: What were participants' perceptions of the beneficial or adverse effects of participating in the technology-focused PD and CoP program?

RQ3b: What components of the technology-focused PD and CoP program do participants perceive as having the greatest value for their development regarding technology self-efficacy, technology competency, technology integration in instructional practices, and knowledge of 21st century skills?

RQ3c: What suggestions for improvements do participants have regarding the technology-focused PD and CoP program?

RQ3d: What are the relationships between individual characteristics (i.e., technology self-efficacy) and contextual factors (i.e., principal leadership support and resource support) and their experience in the technology-focused PD and CoP program?

Outcome Research Questions:

RQ4: To what extent do participants report changes in their technology self-efficacy, competency, and instructional practices following the technology-focused PD and CoP program?

RQ5: How did the participants' perceptions change regarding PD following the technology-focused PD and CoP program?

RQ6: What were participants' perceptions of the impact of the technology-focused PD program on their knowledge of important 21st century skills?

RQ7: To what extent do foreign and local participants differ in their reported technology self-efficacy, technology instructional practices, perceptions of PD, and knowledge of 21st century skills following a technology-focused PD and CoP program?

Research Design

This study employed a quasi-experimental pretest-posttest design using a convergent mixed methods data collection process as the integration of mixed methods enhances credibility (Bamberger, Tarsilla, & Hesse-Biber, 2016). Data were collected concurrently and triangulated using this design. It also allowed for the establishment of an appropriate counterfactual condition, comparing the same participants at two points in time, both before and after the intervention using pretests and posttests, as there was no comparison group (Wiggins, 2018). The philosophical assumption of the convergent design was pragmatism, offering an overarching paradigm for merging the two compatible approaches to provide a more profound understanding of the findings relative to the research questions (Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2003). Through merging these two approaches, the convergent design allowed for flexibility and the portrayal of a holistic perspective (Morrison, 2017b) as well as the combination of quantitative deductive and qualitative inductive hypothesis development (Bamberger et al., 2016), presenting a more comprehensive, significant data set for analysis. The rationale for this selection included triangulation of data through convergence and corroboration, complementarity through elaboration upon findings, initiation to potentially reframe research questions, and expansion of the research breadth through both methods (Johnson & Onwuegbuzie, 2004; Onwuegbuzie & Leech, 2006). It also allowed me to explore the problem through multiple lenses and led to practical outcomes (Morrison, 2017a).

The logic model (LM) guiding the intervention design is in Appendix K. It depicts the relationship between the foundational components of the program and aligns with the revised conceptual model (see Figure 3.1) noted in the intervention literature review. The LM highlights the program inputs; outputs regarding activities and participation required; short-, medium-, and long-term outcomes; as well as assumptions and potential external factors. Key inputs included support for recruitment to reach 50 participants, and essential activities involved a significant time investment for the PD program creation and document translation. The following section outlines the process and outcome evaluation plans for the intervention depicted in the LM.

Program Evaluation Plan

Two types of program evaluation include process evaluation and outcome evaluation. Process evaluation focuses on providing information to improve the program, and outcome evaluation functions as an impact assessment focused on whether the program achieved its goals (Rossi, Lipsey, & Freeman, 2004). These two approaches consider the three principal features of the evaluation context, including the evaluation's purpose, the structure and circumstances of the intervention, and the available resources (Rossi et al., 2004). The process evaluation approach offers essential insight regarding the program's structure and services and how to raise their quality through the participants' voices and feedback relative to their experience. The outcome evaluation provides a comprehensive picture of the potential effect of the program on participant development. Overall, the evaluation plan integrated formative and summative feedback for improvement and future implementation of the intervention PD and CoP program to lead to more successful outcomes. The research matrix for this study is in Appendix L, offering an overview of the process and outcome data collection plan as well as method and measures for collection and analysis of data to achieve the evaluation objectives.

The process evaluation focused on understanding individual contextual support participants receive, fidelity of implementation of the program, participants' experiences in the intervention program, and areas of improvement of the intervention (Rossi et al., 2004). It involved three major components. The context component included aspects of the intervention's environment, including social and economic elements that impacted program implementation (Baranowski & Stables, 2000; Linnan & Stecker, 2002). The implementation of program component involved reach (i.e., who participated), dose (i.e., what the program delivered), dose received (i.e., what participants received), and fidelity (i.e., the quality of the intervention delivered) (Linnan & Stecker, 2002). Finally, the initial use and process use component helped demonstrate the extent to which a participant implements the program suggested activities in his or her classroom, reviewing the important element of moderation of intervention effects (Baranowski & Stables, 2000). Each of these elements provided insightful formative feedback regarding the implementation of the LM. The study employed a variety of instruments, including surveys, an interview protocol, and field notes. Through comparison and triangulation, these data sources provided evidence of the implementation process of the program.

Outcome Evaluation Plan

In addition to assessing the various process evaluation components previously noted, outcome evaluation was also critical as it highlighted the change, if any, in the participants as a result of the PD and CoP program (Rossi et al., 2004). Through thorough analysis, it investigated the four factors, including teacher technology self-efficacy, teacher technology competency, teacher technology integration in instructional practices, and teacher knowledge of 21st century skills, that were potentially affected by the intervention (Rossi et al., 2004). Both the revised conceptual model (see Figure 3.1) and the LM (Appendix K) highlight these outcomes on which the evaluation plan focuses. The long-term objectives the intervention intended to accomplish related to student education outcomes included: (a) raised student achievement, (b) increased student engagement, (c) growth of student technical skills and proficiency, and (d) enhanced use of 21st century skills in classroom settings. Through this structure of goals, the intervention worked to provide a context in which participants may improve their abilities so that changing instructional practices may support student learning. I selected the outcomes based on the theory of treatment (Appendix M) and the research regarding successful PD presented in the intervention literature review.

Method

This section outlines participant characteristics, study measures, and procedure. It includes a full description of the PD and CoP intervention as well as the program evaluation's data collection and analysis. I collected quantitative and qualitative data simultaneously using multiple instruments to triangulate the findings. The surveys provided data for statistical analyses relative to the research questions, and the interviews with participants added insight and more in-depth understanding related to the factors in question.

Participants

Participants had similar characteristics to those described in the needs assessment study. They included 47 Chinese and international teachers working in K-6 classrooms within the Chinese international school community. Of these 47, four dropped out, and six did not complete all of the surveys provided, resulting in data analyses including 37 participants' data. Table 4.1 summarizes the participant demographics with a full table reported in Appendix N.

Table 4.1

Summative Intervention Participant Demographic Information

Code	All Participating Teachers Mean (*SD*)	Chinese Teachers Mean (*SD*)	International Teachers Mean (*SD*)
Age	33.41 (*8.31*)	31.35 (*6.61*)	35.82 (*9.60*)
Years of Teaching Experience	7.65 (*7.25*)	5.90 (*6.13*)	9.71 (*8.08*)
Years of Technology Experience	5.12 (*4.56*)	4.38 (*3.75*)	6.00 (*5.35*)
Gender	f = 28 m = 9	f = 18 m = 2	f = 10 m = 7
Grade			
Kindergarten	17	8	9
Grades 1-3	9	5	5
Grades 4-6	11	7	4
Subject			
English	16	9	7
Science	3	1	2
Math	1	1	0
Arts	3	3	0
Chinese	1	1	0
Computer	1	1	0
Multiple	12	4	8

The study included 28 female teachers (75.68%) and 9 male teachers (24.32%). The range in ages was from 23 to 54 with 15 teachers (40.54%) between 20 and 29 years of age, 14 teachers (37.84%) between 30 and 39 years of age, five teachers (13.51%) between 40 and 49 years of age, and three teachers (8.11%) between 50 and 59 years of age. The mean teacher participant age was approximately 33.41 years of age (SD = 8.31) with a mean age of Chinese participants of 31.35 years of age (SD = 6.61) and a mean age of international participants of 35.82 years of age (*SD* = 9.60). The teachers had between a half year to 29 years of experience with only nine participants (24.32%) having 10 or more years of teaching experience. The mean years of teaching experience was 7.65 years (*SD* = 7.25), which represents a cohort of teachers relatively new to the profession. The years of technology experience was slightly lower with a mean of 5.12 years (*SD* = 4.56) with international participants having a slighty higher mean of 6.00 years (*SD* = 5.35) than Chinese participants at 4.38 years (*SD* = 3.75). For 19 of the 37 participants (51.35%), the years of teaching experience equaled the years of technology experience with the 18 additional teachers (48.65%) having less experience with technology.

Eleven teachers were Caucasian (29.73%), two teachers were Black (5.41%), one teacher was Hispanic (2.70%), three identified as mixed race (8.11%), and 20 teachers were Asian (54.05%), all originating from China. The teachers all graduated with at least a bachelor's degree in education focused on either early childhood, primary, secondary, or general teaching. All Chinese staff held certification to teach in China. International teachers originated from the United States (*n* = 9), Canada (*n* = 1), Australia (*n* = 1), Ukraine (*n* = 1), Cameroon (*n* = 1), South Africa (*n* = 1), Ireland (*n* = 1), Bahamas (*n* = 1), and Norway (*n* = 1), representing approximately 45.95% of participants. The remaining 20 participants (54.05%) were local Chinese.

The teachers represented the full range of primary school grade levels from kindergarten to sixth grade with 17 teaching kindergarten (45.95%), nine teaching first to third grade (24.33%), and 11 teaching fourth to sixth grade (29.73%). The teachers taught a wide variety of subjects with 16 teaching English (43.24%), three teaching science (8.11%), one teaching math (2.70%), three teaching arts-related classes (8.11%), one teaching Chinese (2.70%), one teaching computer (2.70%), and 12 reporting teaching multiple subjects.

Measures and Instrumentation

This section describes the process and outcome evaluation instrumentation. The research matrix (see Appendix L) offers further information regarding the alignment of each research question, construct, measure, data collection procedure, and data analysis process for the evaluation of this study. All measures were presented bilingually in English and Mandarin. To guarantee the accuracy of the translation, I employed a translation and back-translation procedure, using two fluent bilingual research assistants. First, one of the research assistants translated the original English version into Mandarin. Next, the second research assistant translated the Mandarin version back into English without viewing the original English version. I then compared this new English version with the original English version with the two research assistants for alignment and accuracy. Since no issues arose, I combined the English and Mandarin versions into a bilingual format.

Demographic survey. The Demographic Survey (see Appendix O) captured several moderating variables related to the participant teachers, including age, country of origin, ethnicity, gender, grade level, subject taught, years of teaching experience, and years of technology experience.

Process evaluation indicators. I used several process evaluation measures to examine the intervention implementation. Process evaluation considers the three principal features of the evaluation context, including the evaluation's purpose, the structure and circumstances of the intervention, and the available resources (Rossi et al., 2004). The measures offered insight regarding the program's services and how to raise their quality based on stakeholder feedback (Rossi et al., 2004).

Context interview protocol. The six-question Context Interview Protocol (see Appendix P) captured participants' types of contexts of professional practice, including different social and economic factors (Baranowski & Stables, 2000). It was also used to assess levels of contextual factors from different sites (Baranowski & Stables, 2000) since participants came from multiple school settings. Sample questions included, "Please describe the budget, if any, you receive related to technology to support your classroom instruction," and "Please describe the school culture related to technology integration."

Dose received survey. The Dose Received Survey (see Appendix Q) focused on participant program awareness, message awareness, and usage of materials (Linnan & Stecker, 2002). It measured the implementation of the program and was used to determine the internal validity as well as identified ineffectiveness due to low implementation (Baranowski & Stables, 2000). The survey's purpose was to assess participants' awareness of important delivered program information to help understand their experience regarding the program from their perspectives. Participants completed the same five items in a short online survey at the end of each of the seven sessions for a total of 35 questions. Participants responded to these questions on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree).* Sample items included, "The program purpose for this session was clear," "I understood the purpose of this session," and "I feel confident I can apply the knowledge from this session in my classroom." One additional question was part of the last session survey: "Have you been exposed to any other technology-related PD program or any outside technology-focused professional learning opportunity since September?" This question was included to capture any additional technology-related PD that may have influenced participants' experience during the PD and CoP program, which may compromise the internal validity of the present study.

WeChat artifacts. Artifacts from the WeChat CoP, which were captured in screenshots and chat logs, were used to corroborate data on fidelity of implementation. These artifacts also captured information regarding participant responsiveness, including teacher involvement, participation, enthusiasm, and student interpretation accuracy. The purpose of the artifacts was to assess participants' awareness of important delivered program information to help understand their experience regarding the program from their perspectives.

Beijing Innovation Project interview protocol. The 15-item semi-structured Beijing Innovation Project Interview Protocol (see Appendix R) included questions related to multiple constructs, and these data were used to corroborate and triangulate findings from several quantitative instruments, enhancing the depth of data collection. It captured participants' opinions and attitudes regarding the intervention's multiple components. The interview protocol consisted of nine sections: (a) initial use and process use, (b) teacher satisfaction with PD, (c) teacher suggestions for improvements for the PD program, (d) self-efficacy, (e) technology competency, (f) technology instructional practices, (g) PD, and (h) 21st century skills knowledge. Each subsection included researcher-constructed items, and items on the instructional practices subsection were adapted from Kim and colleagues (2013).

The initial use and process use section consisted of one question: "Please describe your use of intervention-related activities during and after the intervention. Also, do you plan to use any related-activities and strategies in the future?" The teacher satisfaction with PD section consisted of three questions, "Please describe your experience in and satisfaction with the PD intervention. What did you find beneficial? What did you think was not useful?" and "What components of the program do you think had the greatest value to support you to use technology to support student learning? What components had the least value?" The teacher suggestions for improvements for the PD program section consisted of five questions. Sample questions included, "What suggestions for improvements do you have for the PD intervention and why?"

and “What components of the professional development program were you successful implementing?”

The self-efficacy section consisted of two questions, “Can you talk about your confidence with using technology? What influences your confidence and why?” and “Can you explain in which way the PD influenced your confidence to support student learning? Why do you think the PD had this effect?” The technology competency section consisted of two questions, “What effect, if any, did the PD program have on your technology proficiency to support student learning? Why do you think it had this effect?” and “What would you describe as the major factors influencing your ability to implement technology in your instruction to support student learning?” The technology instructional practice section consisted of three questions. Sample questions included, “What would you describe as the major factors influencing your integration of technology in your instruction to support student learning?” and “In what ways, if any, did the PD program support you to integrate technology in your instruction to support student learning? Why do you think it had this effect?”

The PD section consisted of two questions, “Tell me about your PD experience while working as a teacher regarding technology integration into instructional practices. Does it meet your needs regarding using technology within your instruction? Why or why not?” and “Please describe your ideal professional development approach regarding technology integration.” The 21st century skills knowledge section consisted of one question, “What impact, if any, did the professional development program have on your knowledge of 21st century skills? Why do you think it had this impact?”

Outcome evaluation indicators. Outcome measures must be reliable, valid, and appropriately sensitive to offer credible findings (Rossi et al., 2004). The pretest-posttest design employing the same outcome measure provided a useful framework for comparison of outcome monitoring data with preprogram data regarding the amount of change (Rossi et al., 2004). The study employed four survey instruments and one interview protocol. The following sections divide the measures by outcome evaluation indicator.

Educator Technology Self-Efficacy Survey. One instrument was used to measure teacher technology self-efficacy. The purpose of the 50-item Educator Technology Self-Efficacy Survey (see Appendix S) was to assess teachers' beliefs in their ability, adequacy, and confidence to use technology to affect student performance and improve student construction of knowledge (Cheung, 2008; Pan & Franklin, 2011). The Educator Technology Self-Efficacy Survey was initially developed by Gentry, Baker, Thomas, Whitfield, and Garcia (2014) to measure teacher technology self-efficacy. The authors evaluated the instrument's validity using the International Society for Technology in Education National Educational Technology Standards for Teachers (International Society for Technology in Education [ISTE], 2008) reaching 100% agreement. The expert panel calculated the internal consistency using Cronbach's alpha ($\alpha = 0.96$). This survey had 10-items for each of the five standards noted in the ISTE standards, including facilitating and inspiring student learning and creativity, designing and developing digital age learning experiences and assessments, modeling digital age work and learning, promoting and modeling digital citizenship and responsibility, and engaging in professional growth and leadership (ISTE, 2008). Of the 10-items for each standard, five were negative behavioral items, and five were positive. The instrument measured responses on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*).

Sample items in the Facilitate and Inspire Student Learning and Creativity section included, "I empower my students to demonstrate their creative thinking by using digital tools to generate new ideas and develop innovative products and processes” and “I am able to develop technology-enriched learning environments that enable all students to pursue individual curiosities in an active setting.” Sample items in the Design and Develop Digital Age Learning Experiences and Assessments section included, “I am not aware of digital tools that allow students to take charge of and manage their own learning in terms of exploring curiosities, setting learning goals and learning strategies, and assessing their own progress” and “I am confident in my ability to collect, analyze, and report data on my student's performance in order to improve my own instruction.” Sample items in the Model Digital Age Work and Learning section included, “My prior learning has prepared me to use digital tools to collaborate with students, colleagues and parents” and “I feel as though I do not have the time I need to communicate effectively with students, parents, and peers using digital age media.” Sample items in the Promote and Model Digital Citizenship and Responsibility section included, “I rarely use digital communication tools for my students to interact with other students for online discussions and project teamwork” and “I feel as though I model and exhibit legal and ethical behavior in our evolving digital culture.” Sample items in the Engage in Professional Growth and Leadership section included, “I have been described as a good role model for infusing technology into teaching” and “I sometimes feel overwhelmed when attempting to improve my professional practice by integrating digital tools and resources.”

Technology Beliefs and Competencies Survey. One instrument measured teacher technology integration in instructional practices. The Technology Beliefs and Competencies Survey (see Appendix T) assessed how teachers integrate technology into pedagogical daily instructional strategies, activities, and approaches facilitated in the classroom environment to support student learning (Lee et al., 2013; Li et al., 2012). The 55-item Technology Beliefs and

Competencies Survey by Brinkerhoff, Ku, Glazewski, and Brush (2002) measured teacher technology integration in instructional practices, employing only the last 11 items of the original survey. Educational technology faculty examined the measure for face and content validity. The authors calculated the internal consistency of the 11-item section assessing technology integration using Cronbach's alpha (α = 0.94). The section measured technology integration to support instruction using a 4-point Likert scale from 1 (*Strongly Disagree*) to 4 (*Strongly Agree*). Sample items on the scale included, "I integrate computer activities into the curriculum," "Technology plays an integral role in supporting content learning in my class," and "I encourage students to work collaboratively on technology-based activities."

Professional development scale. One instrument measured teacher perceptions of PD. The 10-item PD scale (see Appendix U) assessed how teachers perceive technology-focused PD programs help them to cultivate the skills necessary for them to be successful with students in the classroom (Guskey, 2002; Lawless & Pellegrino, 2007; Loucks-Horsley et al., 1996). The instrument, adapted from An and Reigeluth (2014), measured the ability of PD to foster skills related to technology integration for teachers to support student achievement. The original scale listed no internal consistency estimates. I, however, tested the instrument with 16 participants and calculated the internal consistency using Cronbach's alpha during the needs assessment study, which resulted in acceptable internal consistency (α = 0.94). The survey contained questions focusing on PD programs in the school context and their perceived effectiveness. I altered the wording of one item, changing, "I am satisfied with my current PD programs and activities" to "The current professional development programs and activities meet my satisfaction." Additionally, the other nine items referenced "they," which I changed to "PD programs" for clarification purposes for participants. For example, I altered, "They help me improve my technology knowledge," to "PD programs help me improve my technology knowledge." The scale measured responses on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree).* Sample items included, "PD programs help me improve my pedagogical knowledge," "PD programs help me create a technology-enhanced, learner-centered classroom," and "PD programs help me improve my content knowledge about the subject matter I teach."

21st Century Skills Teaching Scale. One instrument measured teacher participants' 21st century skills knowledge. The 10-item 21st Century Skills Teaching Scale (see Appendix V) assessed participants' knowledge and views about the importance of 21st century skills. I adapted it from a version by Jia, Oh, Sibuma, LaBanca, and Lorentson (2016). The 10-item instrument measured six key areas in one domain of cross-functioning skills: information literacy, collaboration, communication, innovation and creativity, problem solving, and responsible citizenship. Peers confirmed the face validity of the operational definitions. Expert review was used to confirm the face validity of the instrument items, analyzing relevance, consistency, clarity, and uniqueness. Field testing also occurred with pre-service and in-service educators, who provided feedback. An in-service teacher test of the 10-item model calculated the internal consistency using Cronbach's alpha, which resulted in acceptable internal consistency ($\alpha = 0.96$).

I have, however, heavily modified this scale to better suit the purpose of the study, and therefore this internal consistency value cannot be relied upon as accurate. First, all references in the questions to STEM were removed to better align with the present study. For example, I altered the wording, changing, "Engaging students in collaborating with peers to achieve a goal on a (STEM) project" to "Engaging students in collaborating with peers to achieve a goal on a project." Second, the original scale used a 7-point Likert scale to measure confidence in teaching activities defined by each item ranging from 1 (*Not at all confident*) to 7 (*Completely confident*). This scale was modified to a 5-point Likert scale to have participants rate the importance of each item ranging from 1 (*Not at all important*) to 5 (*Very important*). Validity and reliability of this new scale were evaluated as part of the present study, but these changes were necessary as I identified no other existing instrument that matched the present study's needs. Sample items included, "Engaging students in collaborating with peers to achieve a goal on a project," "Teaching students to use technical writing to clearly communicate topics," and "Teaching students to respectfully work with individuals from different cultures."

Procedure

The following sections outline details regarding conducting the current intervention, including participant selection, timeline and instructional design sequence, data collection procedure, and data analysis procedure.

Participant Selection. Sampling occurred through a combination of three methods: purposive sampling, non-probability convenience sampling, and snowball sampling. Initial recruitment occurred across the Beijing international school community through my existing social network WeChat channels (e.g., Beijing Administrators Group, Innovative Educators Group, etc.). WeChat is a highly popular social media network used for real-time communication and group sharing both in and outside the workplace. A WeChat Recruitment Ad is in Appendix W. Additionally, recruitment was encouraged through administrators with relevant and interested staff members as well as other participants if necessary.

I purposefully selected 18 of the participants for the in-depth, follow-up interviews after the intervention, using maximum variation sampling to guarantee a wide range of perspectives related to the research questions, including low, medium, and high participant response variations on teacher technology self-efficacy, technology competency, technology integration in instructional practices, and knowledge of 21st century skills. Participants needed to be able to communicate in English at an intermediate level or above for assignment purposes. The program team, which was the same described as part of the needs assessment, certified the participants' English levels through brief informal phone conversations during recruitment, which is typical practice in the education industry in China for evaluating the English ability of candidates. If an individual opted out, another participant was purposefully selected. Purposeful sampling allowed me to ensure a sufficient balance between international (n = 6) and local (n = 11) participants for the interview process. Twelve local participants were sought, but only 11 agreed to be interviewed. More local participants were selected due to the Chinese contextual focus of the study to include a more prominent Chinese voice in the findings.

Intervention. The title of the intervention was the Beijing Innovation Project. It attempted to provide benefits to participating primary educators in Beijing international schools through an online, technology-focused PD and CoP program using the described structure in the LM (see Appendix K) and ToT (see Appendix M). The setting of the PD and CoP was an online forum, using the learning delivery platform Blackboard as well as WeChat as a communication platform. Seven online sessions occurred every week over two months targeting approximately 21 hours of work, which were tested by program staff once the learning management system was online. Sessions covered seven topics: (a) Introduction to 21st Century Skills, (b) Application of 21st Century Skills in the Classroom, (c) Introduction to Technology Integration in the Classroom, (d) Lesson Planning and Application for Technology Integration in the Classroom, (e) Unit Planning for Technology Integration, (f) Unit Planning for Technology Integration, and (g) Review (see Table 4.2). All content for the program sessions was available on the learning management system Blackboard Learn as well as distributed through WeChat, allowing participants asynchronous access to complete each session at their own pace. Additionally, Blackboard Learn analytics were used to collect data regarding participant participation for analysis. Weekly interactions and updates occurred on the WeChat CoP platform through ongoing, open communication around session topics. I employed WeChat as a knowledge sharing and discussion platform throughout the intervention. Screenshots and conversation capture functions were used with WeChat to document participant interactions.

Sessions involved activities for participants, including watching videos, reading key articles, viewing Microsoft PowerPoint presentations, participating in discussion groups, completing individual assignments, sharing related articles, and interacting with fellow participants in the CoP. As most educators in China have WeChat, this app platform pushed notifications and distributed materials. It also acted as the ongoing sharing and social dialogue platform, which was captured in screenshots and chat logs as a source of data associated with RQ2. Products included individually created lessons and a unit outline related to technology integration that participants will implement in their classrooms.

Instructional Goals. I identified several instructional goals for the intervention (see Table 4.2). I selected the targets based on the current literature regarding successful PD.

Table 4.2

Overall Instructional Goals

Session	Topic/Goal(s)

All Sessions	All Each participant will demonstrate full participation in all sessions, activities, and assignments by completing 100% of the program's coursework. Each participant will write one discussion post per PD session and explain and describe the program's effect on their technology self-efficacy, proficiency, and instructional practices as well as their 21st century skillset knowledge. Each participant will experience improved technology self-efficacy, technology competency, technology instructional practices, and knowledge of 21st century skills.
Session 1 11/12 – 11/19	Introduction to 21st Century Skills Each participant will identify the 21st century skills that are important for students and create a list of these skills and how they can apply to their specific students.
Session 2 11/19 – 11/26	Application of 21st Century Skills in the Classroom Each participant will create a lesson plan that demonstrates the implementation of at least three 21st century skills.
Session 3 11/26 – 12/03	Introduction to Technology Integration in the Classroom Each participant will review the materials from the session to receive an introduction of technology integration and identify strategies and applications of technology in the classroom for the next session's lesson plan assignment.
Session 4 12/03 – 12/10	Lesson Planning and Application for Technology Integration in the Classroom Each participant will create a lesson plan incorporating technology tools and demonstrate the implementation of a lesson involving technology integration.
Session 5 12/10 – 12/17	Unit Planning for Technology Integration Each participant will plan and create a framework of a unit involving technology integration, highlighting at least ten opportunities of technology integration throughout the unit to cultivate the growth of student technical skills and proficiency related to 21st century skills.
Session 6 12/17 – 12/24	Same as Session 5

Session 7 12/24 – 12/31	Review Each participant will complete program evaluation surveys and describe their experience in the technology-focused PD program.

Implementation Strategy. The following section outlines the instructional plan of the intervention, providing a brief overview and step-by-step procedure of execution aligned with Table 4.2. A short presession before the intervention was used to collect necessary Johns Hopkins HIRB Letters of Consent (see Appendix X) as well as complete pre-intervention surveys and questionnaires. Participants also completed the study surveys in a brief post session.

The intervention was implemented during the 2018-19 academic school year, approximately between October 2018 and January 2019. The context of the PD and CoP setting was an online forum, using the learning delivery platform Blackboard as well as WeChat as a social communication platform, which were tested to ensure there were no initial connection issues. Issues, however, did arise as noted later. I attempted to engage participants in an online learning model over the program's 2-month implementation. Participants were expected to participate in the program components for approximately 21 hours. Online sessions occurred every week, covering the previously noted session topics (see Table 4.2), with additional weekly interactions and updates happening on the WeChat CoP platform. Example materials for session one are in Appendices Y, Z, and AB. A typical session involved one to three articles, one to three short videos, potentially a Microsoft PowerPoint presentation, possibly a discussion share, and potentially an individual assignment. Sample screenshots from WeChat have been included in Appendix AB, demonstrating article, picture, and video sharing as well as an example discussion between a group.

Data Collection

Data were collected simultaneously following the convergent mixed methods design. Specific data collection procedures for individual measures are outlined in the following sections by instrument, moving from process to outcome evaluation indicators.

Demographic survey. Participants completed the Demographic Survey (see Appendix O) before the start of the intervention online through a SurveyMonkey survey. It took approximately five minutes to complete.

Context interview protocol. The program team employed the context interview protocol (see Appendix P) once at the beginning of the program. A member of the program team contacted participants before the start of the intervention in either English for international participants or Mandarin for local participants to document their responses either over the phone or through WeChat voice calls. The five-item interview protocol took approximately twenty minutes to complete.

Reach and dose data. The program team downloaded the reach and dose session data from Blackboard Learn once for each of the seven sessions. These data included the number of clicks on each page including activity links as well as the time spent working on each page to ensure at least enough time was spent to engage with the content versus a quick click. The Blackboard Learn grade center was also used to monitor participant submission of session elements, including assignments and discussion group posts. It provided data relative to when the participants opened, started, and submitted various session items. Additionally, the program team downloaded files of the entire dialogue on the WeChat CoP once for each of the seven sessions. These artifacts provided the number of participant posts to the group as well as responses in group discussions.

Dose received survey. The participants completed the Dose Received Survey (see Appendix Q) seven times throughout the intervention. At the end of each session, participants completed these items via an online survey on Blackboard Learn and distributed via WeChat by QR code connected to SurveyMonkey. This indicator took approximately five minutes to complete each session.

Participant responsiveness field notes. The participant responsiveness field notes detailed teacher participation, enthusiasm, and interpretation accuracy from my perspective as the program administrator (Dusenbury, Brannigan, Falco, & Hansen, 2003) related to RQ2. I documented the extent to which participants engaged with treatment (Schulte, Easton, & Parker, 2009). The field notes were collected to understand how participants responded to the various sessions and their components within the PD and CoP intervention. The three primary categories of focus in the field notes included (a) teacher participation, (b) teacher enthusiasm, and (c) teacher interpretation accuracy as noted in Table 4.3.

Table 4.3

Participant Responsiveness Categories

Category	Description
Teacher Participation	Teacher participation was a description of participant responsiveness and involvement in each session, including the number of participants who responded to and completed the activities and an account of the comprehensiveness emerging from the responses, particularly related to discussion group activities. It also included a description of participant engagement in the CoP dialogue and sharing through review of WeChat artifacts as well as assignment completion rates.

Teacher Enthusiasm	Teacher enthusiasm was an analysis reflecting whether participants were going beyond minimum sharing requirements on the discussion boards as determined by session requirements, the frequency of participant sharing in the CoP, and whether participants interacted with one another and expressed specific interest in the subject matter.
Teacher Interpretation Accuracy	Teacher interpretation accuracy involved a description of the participants' application of the knowledge learned in each session. The accuracy of their discussion posts and conversations in the CoP was reviewed in terms of whether participants provided a correct description of course content based on the assignment topic. The description also noted whether discussion and CoP entries by participants reflected an accurate understanding of the session material and detailed any areas of confusion or inaccuracies indicated by participants.

Additionally, I took field notes to review CoP WeChat artifacts regarding participant responsiveness. I described participant responsiveness within the field notes once per session within the three categories (see Table 4.3).

Beijing Innovation Project interview protocol. The program team conducted interviews using the Beijing Innovation Project Interview Protocol (see Appendix R) with selected participants at the end of the intervention. Interviews took approximately one hour to complete and were conducted in a private meeting room in each context and through a private WeChat voice or video call to ensure confidentiality and candor of responses. Interviews were scheduled during the participants' planning times during school hours to avoid any interruptions. The program team audio recorded the interviews. Open-ended follow-up questions were asked to clarify a participant's response.

Outcome evaluation surveys. Participants completed all outcome surveys (see Appendices S, T, U, and V) at the pre- and post-intervention stages (i.e., before and after the intervention) online on Blackboard Learn and distributed via WeChat by QR code connected to

SurveyMonkey in a bilingual format, including English and Mandarin. The surveys took approximately 30 minutes to complete.

Data Analysis

Data were analyzed simultaneously following the convergent mixed methods design. Once I initially analyzed the quantitative and qualitative data separately, I then analyzed the data together, searching for areas of triangulation of significant themes and trends. Specific analysis procedures for individual measures are outlined in the following sections by instrument, moving from process to outcome evaluation indicators.

Demographic survey. I calculated descriptive statistics, including the number, percentage, mean, and SD, for items on the Demographic Survey (see Appendix O).

Context interview protocol. All of the interviews were initially transcribed into the language of the participant, Chinese or English. Then, two Chinese research assistants translated the Chinese staff interviews verbatim. Additionally, I checked for accuracy using a translation and back-translation procedure, in which participant statements translated into English by one assistant were translated back to Mandarin by the other for verification.

I thematically coded participants' responses (see Appendix P) using Dedoose to describe participants' contextual experiences related to RQ1. This analysis identified contextual variables from different settings that may impact the outcomes for individual participants. I also reviewed the data specifically for negative and positive experiences regarding key aspects of principal leadership as well as resource support to help understand the participants' experience in the program related to RQ3 and its subquestions. A thematic coding hybrid approach included both inductive and deductive coding as detailed by Fereday and Muir-Cochrane (2006). First, I identified a priori themes related to the intervention and research questions. The following a priori categories emerged from a thorough literature review and served as the initial analytic frame to focus this analysis (see Table 4.4).

Table 4.4

Context Interview Protocol A Priori Categories

Category	Subcategory
Administrative support	Principal leadership
	Teacher development planning
	Technology vision and school plan
Infrastructure	Technology barriers and issues
	Technology equipment available in the classroom
	Technology equipment available in the school
Technology support	Technology facilitator access
	Technology support systems
School culture	Technology school culture
	Teacher support for technology
	Student support for technology
PD	Past technology PD provided
	Current and future technology PD available
	Quality of PD provided

I read and reread the participant responses a total of five times to identify text that aligns with the codes and sort the participant statements into the a priori categories. Next, I noted the common themes within the categories and further sorted and differentiated them into the subcategories (see Table 4.4). When I read the transcripts, I also employed an inductive coding approach associated with grounded theory to identify emerging categories and subcategories to add to the code system based on a comprehensive review and a record of my perceptions (Glaser

& Strauss, 1967). The analysis required constant comparison to combine similar concepts into overarching ones, allowing for the differentiation of themes from one another and explicit identifications of categories (Corbin & Strauss, 2008). I also coded interviews based on the presence or absence of support in various areas, which were then represented in a cross-matrix of support with the technology self-efficacy statements, helping identify any relationships between the two elements. This analysis helped explain any outliers in the data such as when the participant and school codes were compared in a table to search for any relationships amongst the data. I searched for any association that existed between high and low principal leadership, resource support, and self-efficacy assertions amongst individual participants. Then, I compared individual participant data using school codes to search for a pattern across contexts related to the three variables. The cross-matrix of support triangulated with the low and high technology self-efficacy categorical variable from the Educator Technology Self-Efficacy Survey (see Appendix S) helped analyze the relationship between contextual support and development of teacher self-efficacy. Combined with the data related to negative and positive experiences regarding principal leadership and resource support noted previously, these data supported my understanding of the participants' experiences in the program related to RQ3 and its subquestions.

Implementation of program indicators. Two program implementation indicators were used to understand program fidelity related to RQ2. These included the reach and dose data and the Dose Received Survey (see Appendix Q) included in this subsection. After initial data analysis of the individual indicators noted below, I compared and triangulated these data to evaluate a holistic picture of fidelity of the intervention for RQ2 along with data from the participant responsiveness field notes and the Beijing Innovation Project Interview Protocol (see Appendix R).

Reach and dose data. I described the reach and dose data downloaded from Blackboard Learn analytics by calculating descriptive statistics, including the number, percentage, mean, and SD, of the number of program elements participants engaged in for the PD program and CoP to assess program fidelity in RQ2. I specifically analyzed data related to clicks on activity links, the time spent on each page with the understanding this may not detail level of engagement but can eliminate the possibility of a quick click, and the number of assignments of each type submitted. Additionally, I analyzed WeChat CoP conversation artifacts by counting the number of posts and responses by participants per session. I used Dedoose to thematically code the WeChat CoP conversation artifacts using inductive coding to identify emerging categories and subcategories (Glaser & Strauss, 1967). I read and reread the artifacts a total of five times to identify the emergent categories. I then sorted statements into emergent categories. Next, I noted the common themes within the categories and further sorted and differentiated them into subcategories. Additionally, I sorted participant statements as either negative or positive within subthemes, which were used to analyze the WeChat CoP conversation artifacts with other process evaluation data, notably the Dose Received Survey (see Appendix Q), participant responsiveness field notes, and Beijing Innovation Project Interview Protocol (see Appendix R), to answer RQ2, RQ3, and RQ3's subquestions.

Dose received survey. I calculated descriptive statistics for the Dose Received Survey constructs (see Appendix Q), including the number, percentage, mean, and SD, regarding participant program awareness, message awareness, and usage of materials to review program fidelity in RQ2. The sixth item of the final session survey identified if any participants were exposed to external technology-focused PD during the intervention. If any participants answered in the affirmative, the program team followed up with them directly using their participant code to determine the extent to which this compromised the validity of their data regarding the intervention program's effect.

Participant responsiveness field notes. I used Dedoose to thematically code the participant responsiveness field notes using three primary a-priori categories (i.e., teacher participation, teacher enthusiasm, teacher interpretation accuracy) as well as inductive coding related to grounded theory to identify emerging categories and subcategories to add to the code system (Glaser & Strauss, 1967). I read and reread the field notes a total of five times to identify the emergent categories. I then sorted my field note statements into these emergent categories. Next, I noted the common themes within the categories and further sorted and differentiated them into subcategories. The analysis necessitated constant comparison to consolidate similar concepts into overarching ones, allowing for theme differentiation (Corbin & Strauss, 2008). Additionally, I sorted participant themes related to negative and positive statements within participation, enthusiasm, and interpretation accuracy, which were used to analyze the field notes with other process evaluation data, notably the reach and dose data, Dose Received Survey (see Appendix Q), WeChat CoP collected conversation artifacts, and Beijing Innovation Project Interview Protocol (see Appendix R), to answer RQ2, RQ3, and RQ3's subquestions.

Beijing Innovation Project interview protocol. Similar to the Context Interview Protocol, I first had two Chinese research assistants engage in a translation and back translation process to translate all Mandarin interview transcripts into English. I then thematically coded the Beijing Innovation Project interview data (see Appendix R) using Dedoose. This analysis played a role in highlighting negative and positive statements to help understand the participants' experience in the program related to RQ3 and its subquestions as well as other outcome questions RQ4, RQ5, RQ5, and RQ6.

Similar to the context interview protocol, I employed a hybrid approach to thematic coding, which included both inductive and deductive coding (Fereday & Muir-Cochrane, 2006). First, I identified a priori themes related to the intervention and research questions. The following a priori categories emerged from a thorough literature review and served as an analytical frame: (a) technology self-efficacy, (b) technology competency, (c) technology integration in instructional practices, (e) knowledge of 21st century skills, and (f) PD. I did not identify any subcategories in advance other than sorting participants' statements regarding negative and positive assertions within the major categories. The remainder of the thematic coding process of the Beijing Innovation Project interview protocol followed the same procedure as the context interview. By comparing these data with school codes, I was able to examine and triangulate participant data across contexts, identifying emergent patterns related to contextual factors when compared to the Context Interview Protocol (see Appendix P) associated with RQ1 and RQ3d as well as outcome data from the evaluation surveys related to RQ4, RQ5, RQ6, and RQ7.

Outcome evaluation surveys. For analysis of the outcome evaluation surveys, I examined the four major surveys for the key study constructs (i.e., technology self-efficacy, technology competency, technology integration in instructional practices, and knowledge of 21st century skills). The Educator Technology Self-Efficacy Survey (see Appendix S) helped address RQ3, subquestion RQ3b, RQ3d, RQ4, and RQ7. The Technology Beliefs and Competencies Survey (see Appendix T) helped review RQ3, subquestion RQ3b, RQ4, and RQ7. The PD scale (see Appendix U) helped evaluate RQ3 and its subquestions, RQ5, as well as RQ7. The 21st

Century Skills Teaching Scale (see Appendix V) helped provide data for RQ3, its subquestion RQ3b, RQ6, and RQ7.

First, I reverse coded all items that reflected negative beliefs to ensure that all items reflected more positive attitudes with increasing value. Second, I calculated Cronbach's alpha estimates for each scale. Third, I computed descriptive statistics, including the number, percentage, mean, and SD, for all participants using the SPSS software package. Scales were collapsed to merge *Strongly Agree* and *Agree* as well as *Strongly Disagree* and *Disagree* data. Finally, I compared means for Chinese and international teachers using an independent *t* test where appropriate. I used a Mann-Whitney U test if there was a disproportionate number of Chinese versus international participants as in the needs assessment study.

Next, I conducted a paired sample *t* test to compare participants pre- and post-intervention responses to each of the survey subscales. Finally, all survey data were reviewed for a comparison of low and high gains for each of the study's primary constructs. This analysis was done to assess participant experiences associated with RQ3 and its subquestions. These data also supported solutions for the outcome questions, reporting the degree to which participants perceived changes in their technology self-efficacy, competency, and instructional practices following the technology-focused PD and CoP program. I identified participants with the lowest scores below the mean and who also demonstrated a significant difference between pre- and post-intervention surveys, signifying a substantial gain. This review allowed for a comparison of participant change related to the key constructs as a result of the intervention.

I then triangulated these data with the qualitative data collected from the Context Interview Protocol (see Appendix P) and the Beijing Innovation Project Interview Protocol (see Appendix R) at the post-intervention stage. This triangulation process involved a comparison of low and high gains related explicitly to technology self-efficacy of participants and contextual aspects of their contexts. These contextual aspects, specifically principal leadership and resource support, were described in the Context Interview Protocol data. The triangulation of these data allowed me to investigate any potential relationships between the variables associated with RQ3d. Triangulation of participant findings across contexts was executed through a comparison of participant codes with school codes, identifying potential trends that existed amongst participants from the same context with the associated variables. I employed a similar triangulation process with the Beijing Innovation Project Interview Protocol (see Appendix R) searching for emergent patterns of successful elements of the PD and the program.

Summary of Strengths and Limitations of the Design

The evaluation design had several strengths. Through its mixed methods methodology and comparison of pre- and post-intervention results, the study's design allowed for the collection of additional data, produced stronger evidence for a conclusion through convergence and corroboration of results, offered additional insights beyond a single method, increase generalizability, and provided more sound information to inform theory and practice (Johnson & Onwuegbuzie, 2004). Additionally, considering the multiple contextual outreach, the quasi-experimental approach overcame the feasibility issue of maintaining a control group as well as presented opportunities to evaluate the numerous outcomes of the intervention through inferential statistics with enhancement and expansion through detailed, semi-structured qualitative interviews. This combination of data from multiple contexts allowed me to draw valid inferences about the external validity of the intervention's results with the sample size.

The main limitation of the pretest-posttest design is that variable changes cannot necessarily be attributed to program effects due to the potential intervening impact of other processes (Rossi et al., 2004). Although this approach can provide valuable feedback regarding outcome monitoring, it does not offer highly credible results regarding the outcome of a program unless there is the rare case of an absence of intervening events (Rossi et al., 2004). Additionally, without a control comparison, this design was weaker than random control trial approaches, presenting a limitation in data analysis and therefore reliability of the findings. Another drawback was the threat to validity due to the variance in the experimental setting (Shadish, Cook, & Campbell, 2002). Recruitment occurred from multiple international school contexts across Beijing, which differed on several aspects. Shadish and colleagues (2002) note this type of threat can cause inflation of error due to distinctive features of the experimental setting as well as make effect detection more difficult. Different variables impacted the participants and therefore made it difficult for me to make a valid inference regarding the intervention's impact on the four dependent variable outcomes. I mitigated this threat through a brief questionnaire before the intervention highlighting any extraneous factors impacting participants, such as additional PD exposure. Also, nonrandom, voluntary assignment can cause selection bias toward more proactive participants (Shadish et al., 2012). A benefit to this threat, however, was the recruitment from multiple contexts increased external validity by showing generalizability across settings as well as acted to reduce the selection bias due to the variation in participants.

Despite these issues, I preferred this design approach over other design options due to its feasibility considering the contextual setting and challenges as well as the concrete findings it presented in the absence of a laboratory setting with a real control group. The pre-intervention measures, all of which have high reliability from previous studies, helped demonstrate post-intervention gains through statistical analysis as well as helped examine selection bias and attrition (Shadish et al., 2002). The wealth of mixed methods data also assisted to balance the lack of a randomized approach (Shadish et al., 2002). Additionally, the voluntary selection from multiple contexts made alignment of a control impractical. Finally, the mixed methods design allowed me to answer all aspects of the evaluation research questions regarding each factor.

Chapter Five

Findings and Discussion

This section is organized to align with the seven research questions. For RQ1, I thematically coded the Context Interview Protocol (Appendix P), which assessed contextual types regarding support for technology integration to support 21st century learning. For RQ2, RQ3, RQ4, RQ5, RQ6, and RQ7, I examined the survey in conjunction with interview data to triangulate areas of alignment as well as discrepant findings to support assertions related to the study questions.

Reliability Estimates

First, I calculated reliability estimates for each scale and subscale using Cronbach's alpha to assess internal consistency. The acceptable lower end for Cronbach's alpha on a scale is 0.70, although estimates above 0.80 provide greater assurance of internal consistency (Cortina, 1993). Table 5.1 presents the reliability estimates of each scale for the pretests and posttests.

Table 5.1

Pretest and Posttest Reliability Estimates Table

Scale	Pretest α	Posttest α
Educator Technology Self-Efficacy Survey	0.93	0.91
Technology Beliefs and Competencies Survey	0.87	0.89
PD Scale	0.80	0.83
21st Century Skills Teaching Scale	0.89	0.90

As shown in Table 5.1, survey data showed strong internal consistency on Educator Technology Self-Efficacy Survey (see Appendix S), the Technology Beliefs and Competencies Survey (see Appendix T), and the 21st Century Skills Teaching Scale (see Appendix V) with reliability estimates ranging between 0.93 and 0.87 on pretests and 0.91 and 0.89 on posttests. The PD Scale (see Appendix U) had the lowest reliability during the pretest ($\alpha = 0.80$) and posttest ($\alpha = 0.83$), noting only average alignment of items and internal consistency.

Context on Technology Integration

To describe participants' perceptions of their context of support for technology integration to support 21st century learning for RQ1, participants' responses on the context interview were analyzed using thematic coding that employed a priori coding with the potential for emergent codes. A priori categories and subcategories identified in the context interviews included administrative support (i.e., principal leadership, teacher development planning, technology vision and school plan), infrastructure (i.e., technology barriers and issues, technology equipment available in the classroom, technology equipment available in the school), technology support (i.e., technology facilitator access, technology support systems), school culture (i.e., technology school culture, teacher support for technology, student support for technology), and PD (i.e., past technology PD provided, current and future technology PD available, quality of PD provided). In addition to the a priori coding categories described above (see Table 4.4), two additional categories emerged in the context interviews: parents and budget provided.

The context interviews highlighted a pattern of generally negative administrative support for those participants who explicitly noted this theme. This finding represented a major barrier for technology integration by participants as research literature (Chang, 2012; Machado & Chung, 2015; Kurland et al., 2010) noted principal leadership as essential for educators to integrate technology effectively in their classrooms as well as cultivate a culture of technology in their school. Administrative leadership is important to foster organizational leadership related to technology integration within a school context (Kurland et al., 2010; Machado & Chung, 2015). Only two participants commented positively on principal leadership, and five noted negative principal support in their context. One participant, who experienced support for technology integration, pointed out that, “Administration has been very supportive in the use of technology in the classroom. They encourage teachers to develop lesson plans that include some kind of technology usage each day.” Although this participant commented on support, the response only notes encouragement to use technology in lessons, not actual support provided. Other participants highlighted a lack of support from principal leadership. Upon requesting technology hardware for use in the classroom, one participant was called a “lazy teacher.” Another maintained that technology leadership varied by the individual leader in their school, and a third noted that principal leadership provided few instructions regarding how to implement technology. A fourth highlighted the “conservative” nature of their administration regarding technology use. Each of these responses suggested weak administrative support in contexts across Beijing with some administrations proactively discouraging the use of technology and therefore fostering a negative technology school culture. As a component of the initial conceptual model (see Figure 1.2), administrative and principal support is a key factor related to technology integration in schools as noted by Chang (2012), Dawson & Rakes (2003), Li (2006), and Machado and Chung (2015) with its absence negatively impacting related staff as indicated in participant statements. Pushback from more conservative administrators could potentially tie to research noting a need for PD support to improve technology literacy amongst school leaders (Dawson & Rakes, 2003; Li, 2006).

Few participants commented on teacher development planning with situations varying equally across contexts with approximately half describing receiving development planning and the other half receiving none. One noted that their administration posted on WeChat to inform teachers of outside development opportunities. Another participant, however, highlighted that, “If the school does or does not have a development plan for them (teachers), I do not know.” Coinciding with the lack of administrative support, contexts also provided poor PD opportunities for participants with responses describing contexts with insufficient technology guidance and support, therefore making it difficult for educators to integrate technology effectively, particularly if they were novices. Effective planning and technology guidance is important to build a school environment encouraging technology integration in classroom instruction (Kurland et al., 2010).

Participants detailed a much more negative contextual situation regarding technology vision and school plans related to technology with only one participant commenting positively and five describing the absence of vision. One participant noted, “There hasn’t been a stable or consistent vision” in their context, and a second mentioned that, “I don’t think there is a way for the company to be able to support any idea about using technology in the classroom at the present moment of time.” This consistent absence of technology vision and school plans across contexts highlights a troubling trend in leadership within Beijing school contexts related to technology integration, potentially identifying an important issue which is causing other problems with teachers’ use of technology as described by Kurland and colleagues (2010), who emphasized the importance of a principal’s vision for technology integration. These findings also reflected the results in the needs assessment that reflected an absence of school technology vision and planning by administrative leadership.

A much larger number of participants highlighted themes related to infrastructure in their contexts, although perspectives pointed to a wide array of support available in different environments. This variance impacted what participants viewed as acceptable technology tools with some participants highlighting Smart Boards and iPads in their contexts as acceptable technology integration, while others noted only having access to a projector and still being satisfied. Only four participants noted technology barriers and issues that did not relate to other noted categories. One participant explained, “I am encouraged to use my chalkboard more and PowerPoint less. I was told that parents will complain that the screen will hurt my students’ eyes.” Another participant noted that although technology is encouraged to support student learning, “the classroom tech is in Chinese and there has been no help translating or instruction for use. It seems to be left to non-Chinese faculty to figure out tech on their own.” A majority of participants noted positively that technology equipment was available in their classrooms (n = 26) as well as their school contexts (n = 17), but the descriptions of available technology varied widely from context to context. Although some participants highlighted access to an online system, smart boards, iPads, laptops, online website services, and technology labs, others only noted access to a classroom computer and projector. Although most settings only had teacher technology access, others were described as providing a vast network of resources to students with one participant detailing that, “Students have access to iPads, personal laptops, tablets, and phones every day. They are also taught using various tools such as projectors and learning sites.” Of the contexts with access to updated technology, however, one participant noted that although 25 iPads were available, this did not meet the demand and need of the 250 students in the context, identifying a discrepancy between technology hardware availability and actual student demand. A consistent pattern was not seen across settings regarding access to either technology in the classroom or the school. However, from the participant responses, one can maintain the conclusion that although the infrastructure differed in the settings, the technology tools available never reached what would be described as an ideal situation with updated technology tool access for everyone. Law (2007), Liang et al. (2008), and Wenbin (2012) also maintained infrastructure as a primary obstacle to technology integration in Chinese schools, noting its absence prevents teachers from effectively using technology within their classrooms.

Few participants commented on technology support on their campuses related specifically to technology facilitators as well as technology support systems, suggesting that these were not components found in most contexts. Only two participants highlighted the presence of technology support staff in their schools. One, however, noted that the staff, "speaks only Chinese," and the other highlighted the presence of a full-time technology director to support teachers. The three other participants who commented on technology support systems presented negative views. One highlighted that besides purchasing online technology tools, "there is not much additional technological support." Another maintained that, "The regular curriculum itself doesn't specifically implement any form of technology used to support student learning, and there is no single person or department at the moment, ensuring that it does." A third described broken promises regarding technical support and support systems from the school. From a review of participant responses, technology support emerged as key missing element across contexts. Even when PD is effective, educators need coaching and expert support through technology facilitators and mentors to integrate technogy in their instructional practices (Darling-Hammond et al., 2017).

Participant responses highlighted strong positive evidence regarding support for a technology school culture in their contexts (*n* = 18), though equally strong negative statements also appeared from participants (*n* = 8). Considering the strong link between technology school culture and administrative leadership established in the research literature (Kurland et al., 2010), it was surprising to see such positive evidence of a technology culture in contexts from participants alongside negative statements regarding administrative support. One participant noted that the school's education culture depends on courseware and technology integrated into all aspects of learning, and another noted, "Technology is an integral part of our school's culture." Another participant pointed out that the technology culture varied drastically between different grade levels with higher element levels having higher standards and lower grades primarily seeing basic use only by teachers. These responses were surprising considering the negative administrative and technology support highlighted in the previous sections, reflecting a discrepancy between what teachers viewed as positive support and a positive technology school culture. Several participants detailed a negative technology school culture in their settings, detailing their contexts as actively pushing back against technology integration unless beneficial in some manner. One participant described, "The school does actively encourage the use of technology in words, but only applies training or resources when the school believes 'it looks good for the school image,' not in response to teachers' needs or requests." Another participant, who described resistance from the administration regarding using any technology described, "Now while using my laptop, I have to keep my eye open in case one of the administration members decide to pop by." The negative participant assertions regarding technology school culture related more closely with descriptions of administrative and technology support noted in data earlier as well as in research literature (Wu et al., 2007), describing contexts struggling with the initial steps of technology integration. The absence of a technology school culture prevents sustainable change throughout classrooms in teaching and learning related to technology integration (Wu et al., 2007).

Other than infrastructure, technology-related PD was the most commented on aspect by participants related to their contexts. Statements, however, portrayed an overwhelmingly negative viewpoint toward the past, current, and future technology PD opportunities. Research literature (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007; Zhou et al., 2011) also described that PD does not address the needs of educators in China, often leaving them unprepared to apply principles learned in PD within their classrooms as it did not address their concerns and needs. Regarding past PD, most participants (n = 12) highlighted negative experiences versus positive experiences (n = 6). One participant describing a positive experience noted that only two PD sessions related to technology had been provided in the past because PD is infrequent, but the school maintained a budget for attending outside workshops. Most participants noted technology PD, however, only related anecdotes describing surface-level training on basic technology tools with no in-depth guidance provided on technology integration. For example, one participant described that past PD only included Microsoft PowerPoints and surveys provided by the context. With PD support only provided on this low level, even participants who responded positively were describing basic, fundamental training not suitable to foster teachers to integrate technology into their classrooms effectively. This finding reflects the research literature regarding the basic uses of technology teachers often employ with their students, using it for rudimentary tasks in instruction such as PowerPoint presentations that involve rote memorization and other basic uses (An & Reigeluth, 2014; Becker, 1994; Brush & Saye, 2009; Ertmer, 2005; Russell et al., 2003). These basic technology integration approaches do not involve student-driven, exploratory activities which foster more in-depth construction of knowledge (An & Reigeluth, 2014).

Negative statements regarding past PD were much stronger, however, with one participant highlighting, “At this moment in time, there are many pressing matters and education through technology would probably be somewhere near the end of the priority list.” Many other participants noted a complete absence of past and current PD related to technology. One participant referenced the current intervention, saying, “There is very few things told and show about the use of the technology in the classroom. That’s why this opportunity is very valuable for me.” The overall feedback regarding technology-related PD was negative or basic at best with participant responses suggesting a need for technology-related PD in most contexts. This absence of PD harkens back to the description provided by participants in the needs assessment and potentially suggests an area of need across schools within China and a barrier for technology integration for teachers.

Parents emerged as a general theme related to technology use among some of the participants (n = 7). Several participants (n = 4) highlighted how technology helps them communicate with parents, allowing them to share study reports, videos, lessons on a website, and homework. One participant described WeChat as an essential parent communication tool, “I have parents on my friend lists, we can exchange ideas at any time we want.” Three participants, however, noted that parents negatively impact the use of technology in their contexts. One participant who wished to integrate technology described that, “I was told that parents will complain that the screen with hurt my students’ eyes.” Another participant at a Montessori context maintained, “We have to be cautious about integrating technology as some parents choose us because we don’t have that much screen time in our routines as the admission office has told us.” As parents have a lot of influence in Chinese culture (Law, 2007), particularly in private school contexts, these participant responses highlight how that influence can negatively impact school contexts, specifically related to technology integration. When parents do not have the proper background information regarding technology's ability to positively enhance learning or possess misinformation related to its potential negative effects, their dissenting voices can potentially represent a barrier for technology integration in a school.

Additionally, budget emerged as another theme in the context interviews with participants with both positive (n = 7) as well as negative (n = 6) aspects in their contexts, but a majority of participants described having no idea about the technology budget in their school. Some participants were able to describe specific numbers, and others noted the existence of a budget for general maintenance and support per student. One participant explained, "I have no personally received a budget related to technology. However, our IT department can apply for a budget in order to purchase apps, resources, and equipment." Other participants expressed frustration at the technology budgeting situation. One participant described, "Unfortunately, there was no budget at all for foreign staff at this school, and any information concerning budgets in other sectors were *[sic]* considered the schools' affairs and not disclosed to me." Other participants noted a specific lack of technology-related budget, reflecting research literature findings related to budgetary restrictions in China, which prevent use of technology in schools (Liang et al., 2007). The budget theme once again highlighted the wide variance in participants' different technology environments, making it difficult to draw conclusions based on the findings.

Fidelity of Implementation of the Intervention

To detail the enacted PD and CoP program and the extent to which it was implemented with fidelity for RQ2, participants' responses on the dose received survey were analyzed descriptively. Additionally, fields notes and WeChat artifacts regarding participant responsiveness as well as the initial use and process use item on the Beijing Innovation Project

Interview Protocol were analyzed using thematic coding. The following section describes findings regarding the three primary a-priori categories (i.e., teacher participation, teacher enthusiasm, teacher interpretation accuracy), which were each reviewed for negative (low) and positive (high) assertions. Additionally, tech issues, technology self-efficacy, deadline extension, and program team additional support appeared in the field notes as emergent codes and are integrated into these three sections. Survey results, as well as interview responses, were compared to identify similarities and differences as well as highlight any trends within the data for each of the three main categories. The section also highlights participant initial use and process use of the intervention content. Table 5.2 provides the number of participants who participated in the dose received surveys each week. It also notes the mean number of all participants assessing participants' awareness of important delivered program information to help understand their experience regarding the program from their perspectives related to RQ2 with a higher rating noting better understanding.

Table 5.2

Intervention Summative Dose Received Survey Findings Table

Session	Number of Participants *n*	All Participants *M* (*SD*)
Session 1	23	3.89 (0.58)
Session 2	19	3.87 (0.54)
Session 3	9	4.00 (0.57)
Session 4	5	4.28 (0.61)
Session 5	3	4.27 (0.23)
Session 6	2	4.20 (0.28)
Session 7	0	0.00

	(0.00)

The explicit decline in participation on the dose received surveys each session as the intervention moved forward suggested a substantial decrease in participant responsiveness throughout the intervention, reflecting low participation issues with online PD noted by Russell and colleagues (2009). Although the number of participants (n = 37) who completed both pretests and posttests was high, the highest number of participants who completed the dose received survey (n = 23, Session 1) was lower and decreased throughout the sessions, eventually reaching zero in the final session. Due to these low numbers of completion for the survey, the reliability of the data from the dose received surveys, particularly during the final sessions, is not strong and presents little useable quantitative data when viewed exclusively. One can say, however, that the participants' average mean self-reported program comprehension remained well above three each session, suggesting those participants who completed the dose received surveys not only understood the material and its purpose but also found the information useful and applicable in the classroom.

The decline in participant responsiveness highlighted in the decreasing participation aligned with the findings described in the researcher field notes. Although I attempted to employ ideas from the ARCS model (Keller, 1987) in the intervention's instructional design to maintain engagement and motivation and alleviate attrition issues noted in the literature (Russell et al., 2009), my efforts proved ineffective. Satifaction with PD and interest in suggested strategies is essential to generate high engagement in online PD and encourage motivation within participating educators (Russell et al., 2009). I noted a troubling trend before the intervention even began regarding technical issues experienced by participants related to signing up and gaining ongoing access to the Blackboard Learn platform. Despite being tested by the program team several times on multiple devices, web browsers, and both with and without a VPN, these problems continued. The only potential factor was different telecommunication networks. The technical issues were so pronounced that the program team delayed the start of the intervention to continue to facilitate sign up, even going to the lengths of signing up participants ourselves and giving them the login information. While most participants were able to sign themselves up for the intervention, several required this assistance due to connection issues. Multiple WeChat and email reminders were also necessary to facilitate participants signing up. These sign-up issues persisted into the first session as well, drawing ongoing frustration from multiple participants regarding the technical aspects.

Participation was low from the first session, and this developed into a trend in which participation declined throughout each progressive session until the end. Table 5.3 demonstrates a visual decline in the participation rates from session to session regarding discussion and assignment submission.

Table 5.3

Intervention Session Discussion and Assignment Participation Findings Table

Session	Discussion Participants *n*	Assignment Participants *n*
Session 1	21	13
Session 2	13	6
Session 3	6	N/A
Session 4	6	1
Session 5	2	N/A
Session 6	0	0
Session 7	0	N/A

As seen in the table, participation declined in both discussion posts and assignment submissions. Despite this lack of engagement, participants demonstrated medium to high enthusiasm for the material in the CoP, often voicing enjoyment with and appreciation for the session materials.

Table 5.4 demonstrates participation response rates from session to session within the WeChat CoP.

Table 5.4

WeChat Session Participation Findings Table

Session	WeChat Participant Responses *N*
Session 1	64
Session 2	26
Session 3	24
Session 4	14
Session 5	3
Session 6	5
Session 7	9

Note. This does not include program administrators' shares and posts related to PD content.

Findings pointed to a difference in participation and enthusiasm for engagement with content on the online PD platform Blackboard Learn versus that in the WeChat CoP. During the program, participants repeatedly voiced frustration over the technical issues experienced regarding accessing the platform. As all participants and the program team did not experience these issues, it is difficult to identify if these technical issues were real or pointing toward a different problem. I should note that multiple participants repeatedly apologized personally to the program team as well as publicly in the WeChat CoP for falling behind in the course work, citing a variety of personal and work-related reasons. One participant dropped out in session three as a result of these workload issues. As participation decreased, it is possible a snowball effect began as participating individuals viewed fewer participants joining each discussion group, which then led to a cycle of non-participation as individuals were not available to respond to or provide responses. This hypothesis was later confirmed by participant responses in a later section. I attempted to respond quickly to every participant and provide feedback to every discussion in every session to raise motivation and engagement, but this effort was in vain. Due to a delayed start, the ending two sessions of the intervention landed on the winter holiday and resulted in a complete absence of measurable participation beyond discussions in the CoP. Participants once again noted they watched and enjoyed the materials distributed in the CoP, but discussion and survey elements on Blackboard Learn saw no participation.

Although participation was low, participants expressed enthusiasm regarding their learning and growth in the CoP and early discussion responses, particularly in sessions one and two. Participants described not fully understanding the extent of 21st century skills beyond technology integration and being happy to expand their horizons in this regard. Participants also requested additional articles, videos, and other materials through the CoP. At the end of the program, participants also asked that the WeChat CoP group remain open to continue to share technology integration resources. As of approximately four months after the end of the intervention on May 8, 2019, it still maintained a membership of 46 members, not counting the three program team members. Participants also were highly enthusiastic about participating in the post-intervention survey (n = 37) as well as the post-intervention interviews (n = 17). A few participants (n = 3) also sent follow-up emails, thanking me for the opportunity to participate and mentioning how much they enjoyed their learning experience. Additionally, the majority of assignments submitted were of both high quality and accuracy, demonstrating a comprehensive understanding of the material and often going above and beyond the discussion post and assignment instructions. As the intervention progressed, it was clear that the few discussion posts and assignments that continued were from a select group of high achievers, who put extra effort into the program.

The participant responses on the Beijing Innovation Project Interview Protocol identified a divide amongst participants regarding initial use and process use both during and after the intervention. Participants were split regarding whether they did (*n* = 10) or did not (*n* = 7) actively attempt to apply the learned material from the PD program in their classrooms. For example, one participant explained, “I have written a lesson plan, and then I actually tried to implement it in my classroom. So, I think the assignments were very useful as well.” A third participant described in detail the application of the content, “I implemented the collaborative learning kind of right away in my class so that was very positive, and I really like that idea of - like kind of - I changed the structure of my classroom and I moved to desk around so the students could sit better.” These responses showcased that the intervention had some positive impact on technology integration practices of participants in their classrooms.

The majority of participants noting initial and process use (*n* = 7), however, explained their use was in the thought process stage, not the actual implementation stage. One participant described, “I have thought about using them. For example, I have been thinking about how to integrate technology when I create the plans. I will also reflect on some questions and suggestions we have had before in the program.” Another participant mentioned, “Since I joined the program while designing teaching activities and curriculum, I have started to consider if the activities will help children to learn 21st century skills, and how I can create better activities with the help of technology. So, I think it’s very beneficial.” Although these findings point toward a positive growth in participant thinking, the responses do not highlight use of intervention content in the participant classrooms at the current time. Additionally, even those who did indicate engaging with the material and implementing it within their classrooms only actively participated in the early sessions, which was consistent with data from the dose received surveys. This decline of the involvement is described further in the next section for RQ3 related to the participants’ experiences.

Participant Experience in the Intervention

To explain participants' experiences within the online PD and CoP program, participants' survey responses were analyzed descriptively, and their interview responses were analyzed using thematic coding. For RQ3, RQ3a, RQ3b, and RQ3c, the Beijing Innovation Project Interview Protocol was analyzed using thematic coding that employed a priori coding with the potential for emergent codes. Emergent codes played a more important role in sorting participant statements for RQ3 and its subquestions with the following categories and subcategories aligning with research questions: participation and satisfaction, including satisfaction rating, negative assertions, and positive assertions; valuable content, including negative and positive assertions, under the a priori main theme PD; and suggestions for improvements. For RQ3d, data from the context and Beijing Innovation Project Interview Protocol were analyzed using thematic coding that employed a priori coding with the potential for emergent codes and survey data related to the Educator Technology Self-Efficacy Survey were analyzed descriptively. These data were then triangulated to determine the relationships between individual characteristics (i.e., technology self-efficacy) and contextual factors (i.e., principal leadership support and resource support) and their experience in the technology-focused PD and CoP program.

The participants overall rated the program well based on question four on the Beijing Innovation Project Interview Protocol requesting a satisfaction rating. Sixteen of the 17 interview respondents provided the program an above average rating (M = 3.98, SD = 0.97). Of those who rated the program highly, participants commented on the high-quality of the program content as well as the helpfulness of the support staff, mainly when technical platform issues were encountered. For example, one participant highlighted, “I think the program deserves a high score. I will rate it at 5. Because the intention is very good, also the content during the seven weeks, and the support we have received are all positive.” Another participant made similar observations, nothing, “I think the program is good. Your team is excellent.” The high satisfaction rating was somewhat surprising given the low participation, potentially pointing to participants wanting to provide socially desirable responses.

Participants, however, alleviated this potential issue through their direct responses. Several participants (*n* = 6) who rated the program average and high noted that although the program was good, their participation was low. For example, one participant explained, “I am very satisfied with this project and can give full marks. But because my participation is not too high, my child was in the hospital for a while; I did not participate fully. I was fully involved at the beginning, but I was not later on.” In another instance, one participant noted an inability to rate the program higher due to a lack of participation, saying, “I would rate it pretty high. I think certainly a three, but even a four. I wish, I guess I feel a little hesitant to give us the highest mark because I didn't finish. It was more than I wanted.” These responses reflected a discrepancy between high scores and full participation in the intervention. The participant who gave the lowest rating (1) also pointed out issues with engagement:

> I think the intention is good. However, the participation rate is low for people like me. I don't know if it's different for teachers from other schools. At least for me, it is challenging to participate. I think when designing the program, you have to consider audiences like me. I don't know if I am an exceptional case.

It is important to highlight the high number of participants who pointed out their lack of participation in the intervention later stages and a loss of motivation throughout the process as it relates to areas of engagement needed in online PD. Based on responses in the interview protocol, this decline in engagement was attributed to four main themes: (a) commitment time/busy schedules, (b) workload, (c) technical issues, and (d) communal impact of decreased participation. Syntheses of seminal PD literature (Darling-Hammond et al., 2017; Desimone, 2009; Loucks-Horsley et al., 1996) also highlight adequate workload as one of seven components of effective PD. This same research also maintained that a collaborative environment is an important component related with findings describing the communal impact of declining participants within the program cohort. An adequate workload for participating educators helps foster engagement and eliminate frustration, leading to higher participation and more active learning (Desimone, 2009).

Several participants (*n* = 8) noted their decrease in participation related to substantial outside schedule factors. One participant explained, “So at least before 6:00 pm, I am always busy with work, including reviewing students' assignments and preparing lesson materials. Then, when I finally get the time, I need to go back home to take care of my two children.” A second participant described a similar situation, noting:

> I think that sort of motivation isn't necessarily there to participate because we are all in different stages of our lives. Like, okay, I have a full-time job. I've got to do this. And then, oh, I have this person's wedding I need to go to, and we have so much going on, it’s very easy to kind of forget about everything else. A lot of times, I think that can also contribute to a lack of participation.

Based on participant responses, working teachers with a full-time job have a difficult time keeping up with outside course work due to school commitments and busy schedules, pointing to areas requiring additional focus and innovation for online PD to be successful.

The excessive workload of the PD program also played a factor in the decline in participation, affecting Chinese and international participants equally with no discernible difference between the two groups. Although this had been a concern of mine before the intervention and the planned workload was reduced, participant responses highlighted that the workload still was too much for working educators. One participant noted that this was experienced by most participants, claiming, “I have talked with some people around me who are also in the program and learned that none of them had time to finish reading all the materials.” Another participant explained how the compounding workload from each session led to declined participation, mentioning:

> I think that I found the course to be quite a bit more than I expected. There was a lot of materials that was expected to be read, and a lot of assignment activities were lengthy. Ah, so I started off pretty well committed, and I tried my best to keep up with the schedule, but I think, really by this forced assignment, I was falling farther and farther behind. And honestly, I just kind of stopped doing the assignments.

These comments by a majority of the participants suggest the need for program administrators to consider workload balance, expectations of participants, and program length when creating a PD program, reflecting findings of effective principles of PD noted by Darling-Hammond (2017), Desimone (2009), Desimone & Garet (2015), and Loucks-Horsley et al. (1996). Adequate workload, expectations, and duration help ensure a substantial impact of PD through the connection of knowledge and beliefs to a PD program’s specified goals (Desimone, 2009).

Technical issues also contributed to decreased participant motivation and engagement, highlighting an important area of attention necessary for online PD as it can negatively impact participant engagement before a program has even started. One participant supported this notion explaining that the platform connection issues ruined the learning experience, “Firstly, it is due to the experience. It takes too much time to get on the platform. It has put people’s patience into test during the process.” A second pointed out that a more mobile-friendly platform works better with those with a busy schedule, explaining, “It is more convenient for me to read things on my phone. Since this platform is so inconvenient for me to log in, honestly, I haven't participated in any of the activities. I have been thinking about it, but I haven't done it.” Several participants raised technical access issues related to the online PD platform Blackboard Learn during the intervention as well as the interviews despite an extensive pre-intervention investigation and test period by the research team, identifying an area of concern and consideration when hosting online PD training in the future for a Chinese-based audience. For an online PD program to be effective in a Chinese context, it must consider using a platform directly hosted on local Chinese servers and easily accessible on a multitude of devices and browsers to avoid any of the connection issues noted by participants that ruined their PD experience.

Finally, the communal impact of decreased participation negatively affected highly engaged participants, eventually leading to a decline in their engagement as well. This finding aligns with results noted by Henderson (2007), maintaining the importance of motivation of a community environment related to ongoing participation and accountability in the learning process. Sustained participation and engagement in PD is important to provide a transformative learning experience, which will impact educator practices in the classroom (Henderson, 2007). One participant explained this decreasing sense of community, describing, “Gradually, we had fewer and fewer people left week by week. Finally, I felt there’s no one left to learn together with me. It’s become extremely difficult for me to carry on as well since there was no community to discuss anymore.” Another participant supported this notion of a lack of participation impacting the wider community, explaining:

> I think maybe what was also more difficult was the idea of the sense of community I think was very difficult to maintain, like the discussion boards. I love talking and writing

> very clearly since all of my discussions were like, but I found that towards the end, they got very difficult to be motivated because it's like nobody reads them, nobody ever responds to them.

These participants statements point toward the compounding impact that a lack of participation has on a broader group of PD participants, especially when they are linked together in shared tasks, such as discussion groups and WeChat shares, and how it can result in even highly engaged participants losing motivation and stopping participation. These statements are related to RQ2 and provided evidence supporting the rapid decline in participation rates noted in the dose received surveys, discussions groups, and assignments. The finding is important as it highlights how an online PD and CoP cohort operates almost as one entity and not individuals, particularly regarding group discussion tasks, and that aspects such as attrition and decrease in participation can have a lasting, negative communal impact and cause participants to view the learning process as losing value (Booth & Kellogg, 2015; Henderson, 2007).

Participants' perceptions of the beneficial and adverse effects. The participants overall (*n* = 15) maintained that engaging in the technology-focused PD and CoP program produced beneficial effects. No participants highlighted any adverse impacts of participating in the PD program. Beneficial themes specifically highlighted in participants' responses to the Beijing Innovation Project Interview Protocol included content knowledge and useful resources, feeling these two elements contributed the most benefits to their professional learning experience.

Regarding content knowledge, one participant explained, "I feel some of the content in the program was very good. I have learned some in terms of the different aspects of child's development." Another participant noted how the PD program content was helpful for classroom practice, stating, “I think those short videos with suggestions on how you can use technology in the classroom are quite helpful.” Participant statements pointed toward the critical nature of high-quality, content-focused PD, particularly the necessity to make it relevant and practical to the classroom. This finding related to PD research literature detailing the importance of a learner-centered focus on classroom-related content (Desimone & Garet, 2015; Shriner et al., 2010; Vavasseur & Kim MacGregor, 2008). With content that is more relevant and applicable to participants’ classrooms, it could also potentially raise engagement and motivation related to the PD program, which can lead to a more beneficial impact on participants (Vavasseur & Kim MacGregor, 2008).

Participants were also satisfied with the resources shared in the program. One participant explained, “In addition, tools, such as video editing tools, I have been using it all the time, and I am also trying to teach children to use it in class, I think it is quite good.” A second participant explained how the program introduced new ideas, commenting, “You have provided a lot of inspiring resources in this field. After all, this is the field of your research. I did not understand many aspects before.” Many of the participants had not been exposed to ideas within the intervention previously, such as 21st century skills, technology integration strategies, and technology tools, and therefore found them engaging as well as useful for their classrooms. One key aspect expressed by several participants was that even though they knew of resources, they did not know how to apply those resources, which the PD program helped explain to them. This finding pointed toward the idea that participants find content with practical application for the classroom more valuable than theoretical content.

Valuable intervention components. A consensus existed among participants in their responses on the Beijing Innovation Project Interview Protocol regarding the three general components of the technology-focused PD and CoP program that they perceived as having the greatest value for their development and the most positive benefits. These components included (a) the WeChat CoP, (b) the program content (i.e., videos), and (c) additional suggested resources (e.g., tools, websites, etc.).

Participants described the WeChat CoP as a key component to the learning process in the program, both for knowledge sharing as well as sharing of content to overcome technical issues with the Blackboard platform. Sharing of content in the WeChat group was noted by many as a high point of the learning experience in the program, which is related to ideas from situated learning theory and how educators can improve their learning through positive peer interactions and knowledge sharing (Kearney, 2015; Lave & Wegner, 1991). Knowledge sharing between novice and expert teachers helps the latter group grow and expand their skills and knowledge related to a particular subject (Kearney, 2015; Lave & Wegner, 1991). One participant supported this claim, feeling using WeChat embraced the spirit of the program, saying, "However, having the WeChat Group since the beginning is an excellent idea. Because you are using some of the technology, everyone has already known in their life to participate in the program." For many participants, the practicality of WeChat overcame the technical shortcomings of Blackboard and allowed access to the resources with a tool with which they were familiar. A second participant detailed how the learning experience was better in the WeChat learning community than through the actual PD program, explaining:

> So, I think it worked quite well because I learned more actually from the WeChat group than I did from the actual course itself. But definitely the learning community, the sharing of information directly between teachers, and guest lectures that did help ease the learning. Because when you are just reading a paper, you might not fully understand what

> it means but as soon as you talk to somebody about it, as soon as you get their feedback, when and where it can work, that [*sic*] when implementation becomes so much easier, PD becomes so much easier.

This final participant statement points to the core importance and power of communal learning environments to leverage and enhance the professional learning experience, which are core ideas of situated learning theory (Kearney, 2015; Lave & Wegner, 1991; Wenger, 1998). It also highlights the importance of knowledge, content, and strategy sharing between novice and more experienced educators during a professional learning experience as noted by Lave and Wenger (1991) and Wenger (1998).

The program content was also noted by participants as highly valuable, particularly the videos. One participant explained how the videos helped them in the classroom, saying, "Those videos talk about how to apply technology in teaching practices are very good. They are visually direct to take in as they demonstrate how we can use the software and applications." Findings pointed to the ability to understand how to directly implement the program content in the classroom as an important concern of participants. A second participant, presumably local, highlighted the value of the videos in receiving an international perspective, stating, the components with the greatest value were "some more practical resources or tools shared, such as the website and videos, that allow us to see the real classroom abroad." These participant responses once again connect back to the idea of the importance of content being practical for classroom use as noted in the intervention literature review (Desimone, 2009; Donovan et al., 2007; Yan & He, 2012; Zhan, 2008). In particular, the responses point toward the idea that participants need and want clear demonstrations of how to apply new strategies related to technology integration in the classroom. Authentic, practical content is more relevant for educators in their daily practice and therefore is more applicable in instructional practices with students (Desimone, 2009; Donovan et al., 2007; Yan & He, 2012).

Finally, participant responses detailed the additional resources suggested by the program, including technology tools, websites, and other outside elements, as one of the most valuable components. One participant highlighted the value of these resources, saying, “That's probably first and foremost, the most practical thing that I think I got is the list of tools.” This response relates to the broader participant responses highlighting a desire for practically applicable resources, tools, material, and strategies for the classroom. Many participants noted that the technology tools suggested and supplied by the PD program were practical, useful, and new to them. A second participant reinforced how these resources introduced new ideas, “Some of the applications, websites, practical examples are quite useful for me. Generally, there're many resources listed in the program. For instance, PowToon is something we haven’t known before. It is good to learn something like that.” Findings from participants highlighted innovative and new ideas as something they found both engaging and beneficial. These ideas combined with the new resources proved a powerful and successful resource for participants.

Suggestions for intervention improvement. The participants contributed a large number of recommendations for improvements for the technology-focused PD and CoP program, from which emerged six key themes. The six areas of improvement included (a) directly applicable classroom content, (b) more focused content based on student grades/ages, (c) less content in general, (d) necessary cultural adaptations for Chinese participants, (e) addition of a blended approach, and (f) methods to combat low participation.

Many participants (*n* = 9) discussed the need to make the content in the PD program less theoretical and more directly applicable in the classroom. One participant highlighted the need for this adjustment, explaining, “As a teacher working in the frontline, I think what benefits us is the practical part. For instance, how we can integrate technology in the kindergarten classroom or curriculum design.” Participants stressed the need for more authentic examples of application and technology implementation. Another participant elaborated on this idea, saying:

> I think having a little more tangible, real-life example. So instead of describing how to do something, you are showing so this is what a full unit within technology incorporation would look like. Here are some different samples from different teachers. And then also maybe seeing either videos or understanding how. Okay, so we have this here; now let's take a look at how it actually works in the classroom.”

Several participants found that the assignments were too abstract and felt more concrete, applicable examples would improve their learning process. Participant statements once again point to the importance of practicality when considering content selection for a PD program as participants are most concerned with what can be directly applied with students in the classroom, a finding noted earlier as reflected in the intervention literature view (Donovan et al., 2007; Yan & He, 2012; Zhan, 2008). More practical, authentic content can allow impact positively impact educators’ abilities to integrate technology-enhanced, student-centered learning experiences effectively in a classroom setting (Zhan, 2008).

A second area discussed by participants (*n* = 6) was the need to focus the content, making it less broad across the K-6 spectrum and instead dividing participants into groups and concentrating on specific grades or subjects. One participant identified the problem with a broad approach in technology-related PD and understanding the content provided, noting:

> That's really hard, because we're all teaching different grade levels, different subjects, even like - and that's very difficult because it's not specific [*sic*] that okay, we're going to

> work with technology and teaching art to sixth grade. That's very specific, and it's much more simple to come up with.

This suggestion points to the possibility of limiting the enrollment in a future PD session based on a grade or subject to ensure participants can relate to and use all content. A second participant was more direct with the age separation, suggesting, “To improve the program, I would suggest to organize it with divisions of age groups. For example, 0-6, 6-12, 12-18, it works better in this way.” Several participants described being a bit frustrated with content not applying to their students, particularly those teaching children in kindergarten. They noted that limiting the grades and subjects on which one particular PD program focused could help target the material more to participants’ individual needs, making the content more context-relevant for their students. This finding reflected results from Reeves and Pedulla (2013) and Vavasseur and Kim MacGregor (2008), maintaining the importance of PD being context-relevant for participants as more applicable content to their daily practice is more engaging and useful for them with students.

The third area participants suggested improving involved a reduction of the content, a similar issue mentioned earlier in different research questions. Excessive content and workload was a common issue detailed by participants. One participant highlighted the issue, describing, “To improve the program, I would suggest providing more selective and streamlined content. I think his topics and sessions were well-designed, but he has shared too much stuff every time which made people feel there is no focus.” By focusing the material on a single topic, participants felt the material could be more digestible. A second participant expanded upon this idea by explaining how the excessive information had a negative effect, “There are too many recommendations in the course, but I don't know how to do it, so it didn't bring me actual improvement.” Although some participants positively commented on the number of additional resources and tools provided, others suggested a reduced, focused approach. This issue is reflected in the lack of participation as well as workload issues raised related to PD outside of teaching hours, highlighting the need for a delicate balance in PD programs for working, full-time educators.

The fourth area of suggestions from participants related to the cultural adaptation of the PD program material required for China and Chinese participants. One participant expressed the need for cultural adaptation of material, saying:

> Bill has shared some videos from aboard about how technology is used in the classroom. I think the intention is quite good. After that, we may need to make some adaptions based on our own actual situations, environment, and cultural differences. It will need adaptions to apply in our own life.

Other participants commented on the language barrier of the content for Chinese participants. One participant explained, “As for discussions, it is my own disadvantage since my English is not good enough. I will read the discussion content shared by others. Somehow, if I could participate in the discussions in Chinese, I would feel much better.” The language barrier was a factor experienced by several participants and suggests the importance of translating all material in the future for a PD program with participants who speak Mandarin as a first language. Participant responses highlight not only the importance of cultural adaptation for PD in a particular context but also understanding the language as well as other cultural needs of potential participants when building the program. Avalos (2011), Dai and colleagues (2011) and Sang and colleagues (2012) described the importance for teachers to have the support of comprehensive, culturally responsive PD to overcome contextual challenges and improve their learning process. This approach to PD and professional learning can positively influence teachers’ epistemological beliefs, teachers' pedagogical beliefs, and teachers' self-efficacy toward instructional strategies that successfully incorporate technology in classroom settings (Li et al., 2012; Liu & Feng, 2015).

Other participants suggested the needed for a blended approach with live workshops instead of just an online strategy. One participant noted this request, saying:

> I wish I just could see more, um, alive [*sic*] examples. I think it could have, ah, maybe, uh, and a seminar after that. Oh, I'm thinking of another probable [*sic*] improvement of the program if people could meet each other and actually see each other after the program share and have a little like [*sic*] workshop of what how we could do it and what works, what didn't work, like a brainstorm of the idea.

This idea of workshops is related to the point of applicable classroom content highlighted earlier by participants, as the participants expressed the general need for learning relevant to their roles. Desimone and Garet (2015) and Martin and colleagues (2010) supported this finding, noting that classroom-related program content enhances teacher knowledge and leads to higher participant achievement. Another participant supported this idea of workshops, questioning the strength of a virtual learning experience, saying:

> I guess in that setting, um, the application that I felt was not really that strong, but if I think if it were to remember—if the program [*sic*] member at school, if they said take this and put it in the class sometime in the next two weeks or whatever, something like that. Um, I think it would be much more powerful. Um, but just in the kind of virtual blackboard setting. I don't know. I wasn't totally convinced.

These participants' comments suggest the potential need for a blended approach to PD rather than merely an online one, reassuring any concerns with a virtual environment and also meeting the raised demand for more live, practical examples and demonstrations. As discussed in the intervention literature review, Overbaugh and Lu (2008) as well as Owston and colleagues (2008) noted the ability of blended PD to transform instructional practices in the classroom, associating with development ideas in the revised conceptual model (see Figure 3.1). Blended PD can improve the technology competence and confidence of educators as well as lead to long-term retention of these gains (Overbaught & Lu, 2008).

Finally, participants also had suggestions on how to raise motivation and avoid issues of low participation encountered during the intervention. One participant suggested the addition of an incentive aspect for completion, explaining:

> My school has organized some Harvard PD training courses for our teachers. These courses would not give you a degree but will issue a certificate showing how much hours you have spent on the course. Therefore, teachers can put the certificate in their resume or personal files. It would be better to provide teachers with such a certificate demonstrating how much hours they have had for the program. It makes them feel more motivated to complete the course.

This latter suggestion for a certificate was raised by multiple potential volunteers before signing up for the intervention and represents an area of key consideration for future PD programs to both improve program recruitment as well as motivation and attrition.

Relationship between technology self-efficacy and contextual factors. After a careful analysis of the interview data, no clear relationships could be established between individual characteristics (i.e., technology self-efficacy) and contextual factors (i.e., principal leadership support and resource support) and their experience in the technology-focused PD and CoP program. The wide variance in responses amongst the participants made it challenging to draw any consisstent conclusions. Of the 17 participants interviewed after the intervention, 12 described themselves having high technology self-efficacy, and five noted having low technology self-efficacy after the PD program. Despite this separation of technology self-efficacy levels, however, no substantial connection could be established between those with high versus low self-efficacy to contextual factors, such as administrative and resource support.

Many participants did not explicitly comment either positively or negative regarding principal and administrative leadership in their context during the context interviews. Of those that did, however, six participants detailed a positive situation, which included two of the participants noting low technology self-efficacy. One of the low technology self-efficacy participants detailed, “Our school has provided PD training about how to use technology to enhance our teaching and classroom behavior management, as well as home-school communications.” The other participant explained that their context offered facilities support, training course support, and technical question and answer support. Additionally, of the few participants that commented negatively about principal leadership ($n = 4$), all noted having generally good technology self-efficacy as a result of the technology-focused PD and CoP program. Therefore, based on these somewhat contradictory responses, it was not possible to draw a connection between contextual factors and self-efficacy.

The same connection was also unable to be drawn between participants’ technology self-efficacy levels and available contextual resources and infrastructure. For example, 14 participants described their contexts and classrooms as having access to decent technology infrastructure and equipment. This number included all but one of the participants who noted having a low technology self-efficacy. This lone participant explained:

> I think as far as what influence [*sic*] my lack of confidence is just a lot of [*sic*] environmental. I guess [*sic*] environmental really. I mean, I'm not necessarily old that I missed technology. But when I was raised, it wasn't important in my life. Um, I didn't have a cell phone until I was older. We had a computer, but it was really used much, and we will just use it to research things. It wasn't really until college that I was required to actually use my computer.

This response potentially established a link between this individual participant's technology self-efficacy and access to technology resources. However, one participant's data was not enough to draw any relevant conclusions. Additionally, some of the participants (n = 3), who noted having positive technology self-efficacy, highlighted an absence of updated technology equipment and infrastructure in their contexts. Once again, it appears that a contradiction existed in the data between those with positive and negative technology self-efficacy and their access to contextual resources and infrastructure.

Based on the above analysis, it is difficult to make any definitive statements about the relationships between individual participant characteristics (i.e., technology self-efficacy) and contextual factors (i.e., principal leadership support and resource support). As noted previously in the context interview analysis, one common theme among most participants involved an absence of PD in their contexts, particularly any training related to technology. This aspect is the only common thread linking many of the participants. However, the same challenges of connection between low and high technology self-efficacy and context exist as the absence of PD was not universal nor uniform for participants with a particular level of technology confidence. These findings were surprising as research literature linked technology self-efficacy to both principal leadership (Li, 2006; Pan & Franklin, 2011) as well as resource and PD support

(Cheung, 2008; Machado & Chung, 2015; Pan & Franklin, 2011; Zhou et al., 2011). Self-efficacy on a particular task affects one's actions and therefore can increase one's confidence (Bandura 1982, 1997; Pajares, 2002) with both administrative and PD support as important factors that can help raise teachers' self-efficacy (Pan & Franklin, 2011).

Impact of the Intervention on Technology Self-efficacy, Competency, and Instructional Practices

To examine participants reported changes in their technology self-efficacy, competency, and instructional practices following the technology-focused PD and CoP program related to RQ4, their responses on the survey were analyzed descriptively and compared using a *t* test, and their interview responses were analyzed using thematic coding, focusing on the three primary a priori categories technology self-efficacy, technology competency, and technology instructional practices as well as related positive and negative assertions. Pre- and post-intervention survey results were then compared for participant change across the intervention. Survey results as well as interview responses were then compared to examine similarities and differences as well as highlight any trends within the data for each of the three main variables. Table 5.5 provides the means and SDs from the intervention surveys on the pretests and posttests.

Table 5.5

Summative Intervention Pretest, Posttest, and Paired Sample t Test Findings Table

	Pretest $n = 37$		Posttest $n = 37$		Paired Sample *t test*	
	M	*SD*	*M*	*SD*	*t*	*p*
Self-efficacy	3.13	0.47	3.41	0.39	-4.49	0.000071
Technology beliefs and competencies	3.05	0.51	3.23	0.49	-1.80	0.081
Perceptions of PD	3.72	0.53	3.90	0.52	-1.80	0.80
21st century skills teaching knowledge	4.18	0.53	4.18	0.56	-0.047	0.96

Self-efficacy. The self-efficacy pretest mean ratings (*M* = 3.13, *SD* = 0.47) reflected a neutral response from the participants regarding their general technology self-efficacy (see Table 5.5). With a small standard deviation (*SD* = 0.47), there was little variation in participant responses, reflecting a consistency of this neutral perception regarding their technology self-efficacy. The self-efficacy posttest mean ratings (*M* = 3.41, *SD* = 0.39) reflected a more positive response from the participants regarding their general technology self-efficacy. To investigate differences between the participants' pre- and post-intervention technology self-efficacy, I performed a paired sample *t* test. The results revealed a significant difference between self-assessed pre-intervention technology and post-intervention self-efficacy scores (t = -4.49, p = 0.000071). This finding suggests that the intervention was successful in targeting and improving participants' self-efficacy levels related to the use, implementation, and application of technology in the classroom, reflecting similar findings in research regarding PD support and its ability to improve educator self-efficacy (Cheung, 2008; Machado & Chung, 2015; Pan & Franklin, 2011; Zhou et al., 2011). Educators need adequate and thorough preparation to effectively integrate technology into instruction through the support of high-quality PD programs to increase technology self-efficacy (Zhou et al., 2011).

Interview data supported the significant growth in self-efficacy scores from pre- to post-intervention. Several participants (n = 11) highlighted an increase in their confidence in using technology. One participant explained, "I think I'm confident. It's still relatively good. It may be because I am doing research outside the school, studying courses and teaching, and I have contacted many teachers in the school. So overall, the overall confidence level is higher." Another participant clarified the source of their new confidence, noting, "This project has given me a lot of new ideas and resources. In the sharing group, I also saw different teaching methods, which can bring a lot of reference for my teaching." A third participant explained how their confidence improved through a slow, building process, saying, “I think one of the good things about this program is that it shows you guys all [*sic*] so very simple things you can do. But there are some ways that you can use technology that they would um, [*sic*] enhance.”

Other participants detailed that although the program did not improve their confidence, it did present them with new ideas. One participant said, “This program has inspired me to rethink how we can better apply technology in the classroom and what we need to take into consideration when using the technology.” The participant then added, “As I have mentioned, the program doesn’t affect my confidence but helps me to reconsider things and situations like I have said.” Another participant highlighted the discrepancy between the new knowledge and confidence, “Well, I think, I think I have more of an understanding that gives me more tools to research, which gives me more confidence in the sense that I have more at my disposal that I can learn with the technology. But as a general rule, I do not feel very confident.” This latter statement suggested that although the initial PD was a good first step, ongoing PD support was necessary to improve participants’ technology self-efficacy in the long-term.

Other participants (n = 6), however, still expressed weariness with employing technology in their classroom. One participant maintained, “To be honest, I don’t think I am that confident in this.” The primary influence on their confidence appeared to remain environmental within their contexts. As one participant noted, “Although teachers have confidence with all these, if the school doesn’t provide the environment and devices, it will be challenging to make it happen.” As described earlier when discussing suggestions for improvements, several participants expressed the need for more concrete implementation examples to improve self-efficacy as these authentic examples would help them integrate the technology effectively into their lessons and classroom with students. Overall, the findings of the interview data were consistent with the survey data. Several participants noted that the new information and knowledge was important for their enthusiasm to participate. One participant summarized, “And having this new knowledge as to how we can apply this and how these tools can be useful…And now there are things I’m actually thinking about when I stumble upon things. Oh, this is exciting; what can I do with this?”

Technology competency. I assessed participants’ technology competency through self-assessed participant statements collected from the researcher-created Beijing Innovation Project Interview Protocol items # 8 and 9 in Appendix R. Findings regarding technology competency were mixed with some participants (*n* = 9) making positive assertions regarding their growth, others making explicitly negative statements (*n* = 3), and remaining participants not commenting on their technology competency (*n* = 5).

Several participants (*n* = 9) detailed that the program inspired development in their technology competency with themes such as ideas, skills, and importance of practical use noted. One participant explained:

> First, it has helped me to realize technology can provide a lot of help to students in learning. Second, in practice, it has inspired me to learn more new stuff, to use new platforms, and new technology in the future, as well as implement them in the classroom.

The concept of growth from idea generation to actual application and use was a clear theme throughout positive participant assertions. Another participant maintained in detail:

> Well, again, it’s just a matter of use. So, it did have an effect. I used Blackboard. I used all these things that I have never even seen before, and just by, you know, going through

> the steps, even if I didn't succeed in all of them, I have a little bit better understanding. I still don't really know what the cloud is. Like that's a mystery to me, I don't understand that at all. But in many ways, I think that this experience has made me more comfortable using technology. It really did succeed in that aspect.

These participant statements once again highlight the important nature of practical and authentic experiences during PD (Penuel et al., 2007). Teachers' accurate interpretations of PD activities is an important step for effective use with students, and onsite support through authentic examples helps teachers translate learning PD into practice in the classroom (Penuel et al., 2007). According to participants, actual use and interaction with technology is an initial step to developing technology competency and should be an integral aspect for any technology-focused PD program hoping to improve participants' technology proficiency.

Other participants noted the importance of the shared learning experience in the development of their technology competency, particularly with more knowledgeable peers. Research from the intervention literature review (Kim & Cavas, 2013; Lock, 2006; MacDonald, 2008; Snow-Gerono, 2005; Vavasseur & Kim MacGregor, 2008) also maintained the importance of collegial sharing and reflection to the professional learning process as this supports more novice participants to improve their current practices through the guidance of more experienced individuals. Noting first the areas of competency impacted, one participant elaborated, "Yes, the skills and also the way of thinking. For example, you can learn from some other brainier participants, get some inspiration from their experiences, or get some help from the articles." A second participant expanded upon this idea of the importance of community learning related to technology competency, stating:

> Of course, there is [*sic*] some effects. The biggest is it encouraged sharing. When the teachers actually use it in the classroom, they will benefit more. But at least, even if they don't get the chance to use it, it is still new ideas they can think about, it is still a new agenda on their list. It also initiated the communication or interaction among teachers on this topic. There are a couple [*sic*] teachers who responded really well to the sharing.

These statements pointed to the value that participants placed on the WeChat CoP and the benefits it provided by creating a community of knowledge sharing (Booth & Kellogg, 2015; Vavasseur & Kim MacGregor, 2008). Through interaction with more knowledgable peers, some of the novice participants were able to improve their technology integration knowledge based on the ideas the expert participants shared. This finding reflects research from Lave and Wenger (1991) and Wenger (1998), highlighting the importance of the interaction and knowledge between novices and experts in a CoP and its beneficial impact on those with less experience.

Increases in technology competency, however, were not experienced by all participants. Several participants (n = 5) avoided the technology competency question when asked, touching upon unrelated topics or discussing their confidence again. Three other participants made negative statements regarding the program's ability to increase their technology competency. When asked if the program influenced their technology competency, one participant simply stated, "I don't think so." A second briefly noted, "Not that much." The third participant detailed how the program influenced them but not related to their technology competency, explaining:

> In this program, there are some techniques about both life and work, also some creative skills, information skills. These all have directly influenced me. After I learned these things and reflected on myself, I have been trying to learn more related content. As for

> how I can consolidate them and apply them to teach my students, I am still struggling to figure out.

This last participant statement potentially suggests the importance of a practical component to the PD experience to help teachers apply the theoretical concepts within their classrooms. This practical component may be necessary to impact areas such as technology competency as some participants may need that hands-on, authentic engagement to consolidate their learning into a form in which they feel comfortable applying in the classroom.

Despite not being as positive as the technology self-efficacy participant statements, findings overall of the interview data did highlight growth in most participants' technology competency as a result of the technology-focused PD and CoP program. Based on participants responses, reported development would have increased more through practical exposure and applicable use of technology in authentic classroom environments (Hu et al., 2014), a consideration for future technology-focused PD programs. PD that involves authentic practices can help improve teachers' abilities through the exposure to practical concepts, which can highlight gaps in their knowledge and instructional strategies and therefore improve their current classroom practices (Hu et al., 2014).

Technology integration. The technology beliefs and competencies pretest mean ratings (M = 3.05, SD = 0.51) reflected a neutral response from the participants regarding their perceptions of their general technology integration (see Table 5.5). With a small standard deviation (SD = 0.51), there was little variation in participant responses, reflecting a consistency of this neutral perception regarding their technology integration. The technology beliefs and competencies posttest mean ratings (M = 3.23, SD = 0.49) indicated a more positive response from participants regarding their perceptions of their general technology integration. To investigate differences between the participants' pre- and post-intervention technology beliefs and competencies, I performed a paired sample *t* test. The results revealed a trend toward a significant difference ($t = -1.80$, $p = 0.081$) between self-assessed pre- and post-intervention technology beliefs and competencies scores, therefore suggesting minimal growth of participants between the pretest and posttest. This trend was difficult to identify clearly due to the small sample size.

Interview data supported the survey findings, noting very little development regarding participants' general technology integration skills. Participants voiced positive opinions of technology integration as a result of the program, highlighting that it had introduced new ideas, strategies, and methods to work with their students. Their responses, however, suggested educators still in the thought process of integrating technology in their lessons and requiring further instruction. One participant noted, "It did kind of change the way that I'm thinking about…what I should be doing. But I haven't really made any very practical change." This statement pointed toward educators who still were not ready to take the actionable step toward technology integration and required more support through additional PD. A second participant supported this notion and described a similar situation of being exposed to new ideas but not knowing exactly how to move forward with integration:

> In fact, at first, my understanding of technology was relatively narrow. I thought it was the simple things that we normally use now, but the ones that I learned later are relatively high-end, which I have not been much exposed to or learned, so I still have some questions about it.

These responses suggest the need for further guidance on how to transfer their knowledge from the idea stage to the practical application stage in the classroom, reflecting findings from Shriner and colleagues (2010). These authors highlighted that engagement in a collaborative setting with expert-modeled exercises and activities proved highly transferable and applicable to classroom practice from the perceptions of teachers. This assertion also aligned with the revised conceptual model (see Figure 3.1) connecting PD to positive teacher technology self-efficacy, competency, and instructional practices development.

None of the participants expressed opposition to the idea of technology integration with many expressing intentions to try it in the future with their students. As a group, however, the participants voiced uneasiness with moving forward to apply technology in the classroom. One participant described the source of hesitation, "Without that specialty teacher being there, teachers on their own don't have time to push for changes. Also, the teacher do [*sic*] not have enough experience. Lack of experience and methods are the two main reasons." Although ready to begin the integration process with their students, participants expressed the need for a practical component and demonstration to take them to the next step of the technology incorporation process in an authentic classroom scenario.

Interview data also highlighted factors influencing technology integration and use from the viewpoint of the participants. Participant responses detailed five general themes, including (a) infrastructure (i.e., hardware, software, internet access) (n = 9); (b) user knowledge (n = 6), (c) school management and support (n = 6), (d) educational philosophy (n = 3), and (e) age group (n = 3). One participant summarized the variety of factors raised, stating:

> Well I guess what would affect, of course, is what parameters do we have? What are the, um, what is the environment? Is the class of [*sic*] large? Is the class of [*sic*] small? How many desks? How many students? Um, is there one computer? Are there multiple computers? Is there access to tablets um, all of the environmental and resource factors

> definitely would be in [*sic*] effect on can I do this idea I have? or can I not do this idea?…I think those are all effects that would, you know, our resources, I'm sorry, the environmental factors that would affect whether I can or cannot try to implement something.

A second participant highlighted a general concern amongst participants, saying simply, "Without the school behind you, it is difficult." Although the number of potential factors influencing technology integration were numerous, the five elements arose among multiple participants. The array of potential factors raised by participants suggested that technology integration is a complex, detailed process that requires a clear understanding of the parameters involved before the process can succeed in the classroom. Of the five noted factors, four of them, including infrastructure (Tan, 2010; Wan, 2012; Wenbin, 2012), user knowledge (Figg & Jaipal, 2011; Li et al., 2012; Mishra & Koehler, 2006; Rohaan et al., 2012; Sang et al., 2011), school management and support (Chang, 2012; Li, 2006; Machado & Chung, 2015), and educational philosophy (Kim et al., 2013; Lee et al., 2013; Liu & Feng, 2015) were highlighted in the Chapter One literature as factors impacting technology integration in China.

Perceptions of PD after the Intervention

To detail participants' reported changes in their perceptions of PD following the technology-focused PD and CoP program related to RQ5, their responses on the survey were analyzed descriptively, and their interview responses were analyzed using thematic coding, focusing on the main a priori category PD and associated positive and negative assertions as well as emergent categories past PD and ideal PD. Pre- and post-intervention survey results were then compared for participant change throughout the intervention. Survey results as well as interview responses were then analyzed to triangulate similarities and differences amongst participants regarding their perceptions of PD. Table 5.5 provides the means and SDs from the intervention surveys on the pretests and posttests.

The perceptions of PD mean ratings (*M* = 3.72, *SD* = 0.53) (see Table 5.5) reflected a somewhat positive response from the participants regarding their general perceptions of technology-related PD. With a small standard deviation (*SD* = 0.53), there was little variation in participant responses on the pretest, reflecting a consistency of positive perception amongst participants regarding technology-focused PD. The perceptions of PD posttest mean ratings (*M* = 3.90, *SD* = 0.52) potentially reflected a small growth from the participants regarding their general perceptions of technology-focused PD. To investigate differences between the participants' pre- and post-intervention perceptions of PD, I performed a paired sample *t* test. The results, however, revealed no significant difference ($t = -1.80$, $p = 0.80$) between self-assessed, pre- and post-intervention perceptions of PD, therefore suggesting the difference in pretest and posttest findings was not a true difference. This finding suggests that the intervention had no impact on participants' perceptions of technology-related PD.

Interview data portrayed a more positive perception of PD from the standpoint of participants. Half of the participants ($n = 9$) described a positive impression of PD as a result of experiencing the technology-focused PD and CoP program, but with many expressing additional needs at the same time. One participant noted, "I think [*sic*] was great. It was a lot of content, but at the same time there definitely wasn't enough time, especially for those who are at their job." This comment showed a typical response noting the program had a workload that was too heavy for the timeframe provided and therefore suggesting consideration of a proper balance of coursework and time is an important area to address. Other participants offered strong praise for how the program impacted their perceptions of PD. One participant detailed, "I think this project gives everyone a lot of opportunities for communication and sharing. The researcher is also very happy to share resources. Everyone is happy to learn." A second participant with no previous PD experience elaborated on this idea, saying, "The program has really set the bar, and I let Bill know that I think that he set a really high bar." Participants' responses expressed positive feelings toward their PD experience, highlighting strong satisfaction as well as a host of benefits they received.

Not all participants, however, were content with the program with some (n = 3) expressing that it negatively impacted their perceptions of PD. One participant said, "It is not very targeted." This comment was consistent with similarly sentiments expressing suggestions for improvement of the PD program. Several participants felt the content was not targeted enough for their specific age group, potentially suggesting the need for technology-focused PD to be more grade specific in its participant grouping to be effective. Another participant expanded upon their issue with the PD program noting, "For those [*sic*] need more interactive input, [*sic*] is not that useful for me in our school context with our devices provided, students situations, and parents involvement." This response once again reflected responses noted in other research questions as well as the research literature, suggesting that an interactive, hands-on workshop would be more practical for participants to support use in their classrooms (Donovan et al., 2007; Hu et al., 2014; Penuel et al., 2007). Although the negative comments were few, many of the positive comments also suggested areas of potential adjustment to consider that could improve their experience. Exposure to content directly relevant to the classroom can improve participant's growth in PD programs, and changing classroom behavior and actions is more actionable than influencing teachers' content knowledge or inquiry-based strategies (Donovan et al., 2007).

Interview data also described how most participants (n = 12) had not previously participated in any related type of PD experience. One participant explained, “This is brand new to me. So, I don't have any - I have nothing to compare this professional development experience to.” These comments highlighted an absence of previous technology-focused PD amongst the majority of participants and therefore identified an area of need for them in the future to effectively implement technology in their classrooms. Even those who participated in other PD, whether related or not, were not satisfied with their past experiences compared to their experience in this PD program. One participant stated, “There have been some, but they may not be as detailed like this. I have learned or had some understanding of multimedia or how to use multimedia. This is not completely satisfactory.” This dissatisfaction of participants regarding their previous PD could stem from the fact that the majority of PD that exists in Chinese school contexts is related to specific tools (i.e., parent communication tools, grading software) and lectures, therefore not addressing the needs expressed by participants for relevant, hands-on, practical PD that is useful for them in the classroom, a finding supported by research literature (Donovan et al., 2007; Yan & He, 2012). The incorporation of teacher voices allows for PD programs to be more relevant and meet the expressed needs of participants, making content more relevant and actionable (Donovan et al., 2007; Yan & He, 2012). Another participant supported this idea, noting the evolving PD needs of teachers and schools’ inabilities to meet them at the current moment, saying:

> No, they won’t meet the needs. You have to keep learning and participating in some programs. Technology is changing so fast on a daily base. Especially, when it is not that easy to receive information outside the country in China, you have to pay the [*sic*] efforts to keep learning.

This last comment highlighted the importance of ongoing, follow-up PD support to ensure the professional learning experience results in positive change in both the short- and long-term. Sustained support and follow-up was one of the seven principles of effective PD noted in a synthesis of seminal PD research literature as it can lead to more effective long-term gains for participating educators and therefore have more a long-lasting impact in the classroom (Darling-Hammond et al., 2017; Desimone, 2009; Desimone & Garet, 2015; Loucks-Horsley et al., 1996).

Finally, participants also described their ideal PD experience. Several participants felt that ideal PD should involve either face-to-face training only (*n* = 3) or a more blended approach to learning with both face-to-face and online components (*n* = 5). Additionally, the idea of ongoing training and support was raised with one participant summarizing the notion as, "The ideal way of professional development would be keeping learning to be a lifelong learner." Other important comments focused on ideal PD being focused on a single area and hands-on with scenario-based activities. Additionally, one participant highlighted a problem with bringing too many participants teaching varying grade levels together, explaining:

> I think what would be ideal is if there was a professional development program that was differentiated at the beginning to accommodate for different levels of participants. And I would have put myself as a complete novice, like I, because I feel like I'm really at the low end of participants and their familiarity and ability to use technology. So, what would have been more ideal for me is if this was like the very beginning stages of using technology.

This final comment was particularly important as it captured the wider sentiment of the participant group, who felt more focused and targeted PD experiences would be more effective for their learning and later classroom application.

Overall, although participants noted a positive perception of PD as a result of the online PD and CoP program, responses highlighted areas of change that need to be addressed, particularly those online, to provide the most benefits to participants. Specifically, it is of importance that online PD programs integrate materials to demonstrate their key concepts and strategies for participants, allowing them to apply them with ease with their students (Desimone & Garet, 2015; Donovan et al., 2007; Hu et al., 2014; Penuel et al., 2007). The demonstration of actionable strategies and practices in PD make them more applicable for educators in the classroom and therefore more effective with students (Donovan et al., 2007; Penuel et al., 2007). Additionally, program administrators need to adequately balance PD expectations and duration with participants' schedules and workloads (Darling-Hammond et al., 2017; Desimone, 2009; Desimone & Garet, 2015; Loucks-Horsley et al., 1996). Ongoing support, whether through a mentor or additional online learning modules, is also an important consideration for long-term teacher development as it prevents any loss of improvement and gains provided by PD programs (Darling-Hammond et al., 2017; Desimone, 2009; Desimone & Garet, 2015; Loucks-Horsley et al., 1996).

Perceptions of 21st Century Skills Knowledge

To describe participants' reported changes in their knowledge of 21st century skills following the technology-focused PD and CoP program, participants' responses on the survey were analyzed descriptively related to RQ6, and their interview responses were analyzed using thematic coding, focusing on the main a priori category 21st century skills knowledge and associated positive and negative assertions. Pre- and post-intervention survey results were then compared for participant change throughout the intervention. Survey results as well as interview responses were then examined to identify similarities and differences, amongst participants regarding their 21st century skills knowledge.

The 21st century skills knowledge mean ratings prior to the intervention ($M = 4.18$, $SD = 0.53$) (see Table 5.5) suggested a positive response from the participants regarding their general perceptions of their knowledge of 21st century skills, the highest out of all of the surveys. With a small standard deviation ($SD = 0.53$), there was little variation in participant responses, reflecting a consistency of this positive perception regarding their 21st century skills knowledge. The 21st century skills knowledge posttest mean ratings ($M = 4.18$, $SD = 0.56$) reflected no change from the participants regarding their perceptions of their 21st century skills knowledge ($t = -0.047$, $p = 0.86$). This finding suggests that the intervention had no impact on participants' perceptions of their 21st century skills knowledge.

Interview data reflected strong support from participants regarding their knowledge of 21st century skills following the technology-focused PD and CoP program. The participants' responses portrayed a different perception than the survey data, highlighting that the PD program had a positive impact on many participants ($n = 14$). From the responses collected, it was clear that many participants had been unaware of the breadth of 21st century skills before participating in the program and that it provided them a deeper understanding of the core concepts, potentially suggesting the high self-reports on the survey was reflective of an initial lack of understanding or even misunderstanding of actual 21st century skills. For example, as one participant explained:

> Talking about 21st century skills, I had a subjective understanding of them at the very beginning. I thought they mean those skills we tend to mention at [*sic*] a daily base, such as logic, creativity, and critical thinking. But later, I realized that skills and competencies like courage and empathy are also 21st century skills.

The technology-focused PD and CoP program not only reinforced participants' understanding of core 21st century skills, but it also expanded their knowledge, introducing them to a more comprehensive understanding of the subject.

Other participants indicated learning about 21st century skills for the first time in the program but still needed support on how to effectively integrate them in teaching. One participant noted, "I hadn't understood 21st century skills very well before I took part in the program. After I joined this program, I have had a clearer understanding. Since they are quite new to me, it will be a process to digest them." Based on participants' responses, the program had a beneficial impact on their 21st century skills knowledge, opening up new avenues of understanding and application in the participants' classrooms with their students.

Only interview data from three participants displayed a negative impact regarding their knowledge of 21st century skills following the PD program. One participant described the program's lack of influence, "I am still in the stage of learning and understanding different theories and concepts. I do not think there is much differences [*sic*] in learning these theories as they are quite similar." Another participant felt the message was not new information, saying, "It is a repeated message for me. It didn't offer me any new information." Although these responses portrayed a negative opinion of the program's ability to foster 21st century skills knowledge, they could potentially be attributed to more experienced participants who already had a strong fundamental understanding. Taking this perspective into consideration, particularly based on the second participant's response, these negative statements merely reflect a need to differentiate PD to align with the experience of participants.

Overall, however, the interview data portrayed a positive impact on participants regarding their knowledge of 21st century skills for their students as a result of the PD program.

Although the survey data highlighted little change, the interview responses provided insight into the benefits participants' felt they received in this area from the program.

Comparison of International and Local Participants

To explore the extent international and local participants differed in their perceived technology self-efficacy, instructional practices, perceptions of PD, and knowledge of 21st century skills related to RQ7, participants' responses on the survey were analyzed descriptively, and their interview responses were analyzed using thematic coding. I compared pre- and post-intervention survey results for participant change throughout the intervention employing a Mann-Whitney U test due to the different size in groups of Chinese participants (n = 20) and international participants (n = 17). Survey results as well as interview responses were then compared to identify similarities and differences as well as highlight any trends within the data for each of the three main variables. Table 5.6 provides the means, SDs, and Mann-Whitney U test scores from the intervention surveys on the pretests and posttests.

Table 5.6

Summative Intervention Pretest, Posttest, and Paired SampleMann-Whitney U Test Findings Table of Chinese and International Teachers

	Chinese Teachers n = 20		International Teachers n = 17		Mann-Whitney U test	
	Pretest *M* *(SD)*	Posttest *M* *(SD)*	Pretest *M* *(SD)*	Posttest *M* *(SD)*	Pretest *p*	Posttest *p*
Self-efficacy	3.07 (0.40)	3.33 (0.38)	3.20 (0.55)	3.50 (0.39)	0.043	0.247
Technology beliefs and competencies	3.27 (0.41)	3.40 (0.37)	2.78 (0.50)	3.03 (0.55)	0.003	0.050
Perceptions of PD	3.65 (0.47)	3.91 (0.54)	3.80 (0.59)	3.89 (0.52)	0.233	0.951
21st century skills teaching knowledge	4.01 (0.58)	4.12 (0.58)	4.38 (0.38)	4.26 (0.54)	0.024	0.818

Note. T tests revealed similar results to the Mann-Whitney U Test findings.

Self-efficacy. The self-efficacy pretest mean ratings of Chinese participants (M = 3.07, SD = 0.40) and international participants (M = 3.20, SD = 0.55) reflected a neutral response from the participants regarding their general technology self-efficacy. A Mann-Whitney U test revealed a statistically significant difference between mean rating responses of Chinese and international participants (U = 144, Z = -0.793, p = 0.043). This finding suggested international participants had a significantly higher pre-intervention technology self-efficacy than Chinese participants, potentially as a result of more exposure to technology in preservice and inservice educational experiences before coming to China. I then compared the self-efficacy posttest mean ratings of both participant groups. The self-efficacy posttest mean ratings of Chinese participants (M = 3.33, SD = 0.38) and international participants (M = 3.50, SD = 0.39) reflected slight growth in each group's self-efficacy from the pretest, but the Mann-Whitney U test revealed no statistically significant difference between mean rating responses of Chinese and international participants (U = 132, Z = -1.159, p = 0.247). Therefore, the program potentially reduced the gap between these two groups, raising the technology self-efficacy of Chinese participants.

Interview data supported the survey data with participant responses. The majority of participants (n = 11) highlighted growth in their confidence in using technology. This group included six Chinese and five international participants. Of those who felt the program did not impact their self-efficacy, five were Chinese, and one was international. Although the Chinese participants were more evenly split, international participants represented a smaller proportion of the interviewees. Additionally, some of the international participant responses suggested individuals were still unsure about the program's influence on their self-efficacy. For example, one international participant said:

> So, I wouldn't say I'm the most confident in using it. However, I'm not afraid to try and to learn with my kids. So, to like sit here and be like no, I don't know how to do this, you're right, but we can figure it out together and learn together. That I am confident in doing because that's what teaching really is.

Although the participant expressed some confidence, the increase in self-efficacy materialized in a willingness to explore rather than actual growth in confidence with technology. Therefore, overall, the interview data supported interpretations from the survey data, noting a slight improvement in technology self-efficacy for both groups with no major difference between the two. This finding was slightly surprising as it differed from the research literature (Cheung, 2008; Li et al., 2012; Long et al., 2013), which maintained a general low technology self-efficacy amongst Chinese teachers. There is not enough existing data to draw a conclusion regarding this difference, but it could potentially be attributed to the fact that the Chinese educators included in the intervention worked in international schools instead of Chinese public school contexts.

Technology beliefs and competencies. The technology beliefs and competencies pretest mean ratings of Chinese participants ($M = 3.27$, $SD = 0.41$) and international participants ($M = 2.78$, $SD = 0.50$) reflected a generally neutral response from the participants regarding their technology integration abilities. A Mann-Whitney U test revealed a statistically significant difference between mean rating responses of Chinese and international participants ($U = 73$, $Z = -2.964$, $p = 0.003$). This finding highlighted a significant gap in participants' perceptions of their ability to integrate technology between international and Chinese participants with the latter group rating their abilities much higher. This result was somewhat surprising considering data from the previous literature reviews, highlighting a general lack of technology integration experience amongst both international and Chinese educators (Deng et al., 2014; Liang et al., 2007; Spires et al., 2012).

I then compared the technology beliefs and competencies posttest mean ratings of both participant groups. The technology beliefs and competencies posttest mean ratings of Chinese participants ($M = 3.40$, $SD = 0.37$) and international participants ($M = 3.03$, $SD = 0.55$) potentially reflected a slight growth in the Chinese group and a larger development in the international group regarding technology integration abilities from the pretest, but the Mann-Whitney U test revealed a trend toward a statistically significant difference between mean rating responses of Chinese and international participants ($U = 106$, $Z = -1.959$, $p = 0.050$). Therefore, throughout the PD program, the international participant group improved their technology integration abilities enough to eliminate most of the significant difference between their perceptions of their abilities and those self-reported by the Chinese participants. This trend was difficult to identify clearly due to the small sample size. This finding better correlated with current research noting no significant difference in technology integration abilities between international and Chinese educators (Deng et al., 2014; Liang et al., 2007; Spires et al., 2012).

Interview data from participants supported the survey data, which noted more improvement in the perceived technology integration abilities of international participants compared to Chinese participants but a generally positive feeling amongst the entire group. As described previously in the interview data analysis of the technology integration section of RQ4, all participants suggested growth in their interview responses with no participants opposed to the idea that the program helped improve their technology integration abilities. Despite this expressed positive sentiment by participants, many participants did remain hesitant about their abilities and the next step to implementation. This finding related to results noted in similar PD research in China (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007), highlighting that PD often presented few opportunities for actual application by the participants and therefore resulted in little improvement and growth. One Chinese participant provided a clear explanation, detailing:

> I feel that integration takes time. It takes time to exchange and experience, and now there is no such time. I feel that experience is a long-term process that needs to be learned slowly, but we don't have this time. I don't know how to say this. This integration is difficult.

The same participant then added, "If I can use it skillfully, I will go to work hard on [*sic*] integration of it. No matter what resistance there is, I will overcome. But now I have problems with the first step, and the foundation is not very strong for me." Therefore, although both Chinese and international participants felt they had developed, a general feeling of unease related how to move forward to continue to grow and practically expand their technology integration abilities. This uneasy sentiment expressed in participant responses reflected the larger body of research on technology integration abilities and competence of Chinese educators, highlighting an area of need and a focus for future technology-related PD (Cheung, 2008; Long et al., 2013; Pan & Franklin, 2011; Zhao & Xu, 2010; Zhou et al., 2011). Educators often require practical, hands-on examples in PD through demonstrations to apply knowlege from their learning in real classroom settings and make the concepts more useable with students, bridging the gap between theoretical concepts and concrete actions (Donovan et al., 2007).

Perceptions of PD. The perceptions of PD pretest mean ratings of Chinese participants (M = 3.65, SD = 0.47) and international participants (M = 3.80, SD = 0.59) reflected an above average response from the participants regarding their PD perceptions. Results of the Mann-

Whitney U test revealed no statistically significant difference between mean rating responses of Chinese and international participants ($U = 131$, $Z = -1.193$, $p = 0.233$). The perceptions of PD of Chinese participants ($M = 3.91$, $SD = 0.54$) and international participants ($M = 3.89$, $SD = 0.52$) post-intervention reflected slight growth in both groups regarding perceptions of PD from the pretest. A comparison using the Mann-Whitney U test revealed no statistically significant difference between mean rating responses of Chinese and international teachers ($U = 168$, $Z = -0.061$, $p = 0.951$) following the PD program.

Interview data revealed a more complex division amongst the participants with all international participants ($n = 6$, 100.00%) expressing positive growth in their perceptions of PD, and only some Chinese participants ($n = 5$, 45.45%) noting similar development. Several Chinese participants ($n = 4$, 36.36%) either expressed a negative opinion or no strong opinion either way ($n = 2$, 18.18%). Therefore, the interview data did not support the Mann-Whitney U test results. Much of this discrepancy had to do with the dissenting Chinese participants feeling the PD program was not targeted and did not support the improvement of any skills. One Chinese participant described, “Some videos shared by Bill in the program talk about technology in the classroom or the application of technologies in other settings. However, they seldom elaborate on the particular methodology of using the technology. For me, they are a little bit too general.” The participant then added, “People sharing their own experience of how they apply technology in their classrooms are not that directly useful for me as each environment is different from the others.” These responses pointed toward the need for technology-focused PD to be better differentiated to meet participants’ needs and to include authentic, practical demonstrations, an idea expressed in earlier data and research literature (Desimone & Garet, 2015; Donovan et al., 2007; Hu et al., 2014; Penuel et al., 2007). As highlighted earlier, hands-on, practical activities can better demonstrate proper instructional strategies to educators, making them easier to implement with students in a classroom setting and therefore potentially more effective (Donovan et al., 2007; Hu et al., 2014; Penuel et al., 2007). One international participant summed up the general positive thoughts of the other 11 participants, saying:

> I thought it was extremely useful because they opened up all resources and really kind of changed the way that I think about technology and what it means and how we can actually use it rather than to maybe be afraid of it, or maybe just be hesitant toward it. I'm definitely much more excited about it.

Therefore, the complex picture described by the participant responses did not completely support the results of the Mann-Whitney U test with a larger proportion of international participants reporting more positive perceptions of the PD experience than the Chinese participants. It is unclear what to attribute this more positive perception of PD amongst international participants. As noted previously, it could be related to insufficient previous preservice and inservice PD experiences Chinese participants experienced, providing them a weaker foundation of knowledge and skills on which to add the experiences from the technology-focused online PD and CoP (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007).

21st century skills teaching knowledge. The 21st century skills teaching knowledge pretest mean ratings of Chinese participants (M = 4.01, SD = 0.58) and international participants (M = 4.38, SD = 0.38) reflected a positive response from the participants regarding their 21st century skills teaching knowledge. The Mann-Whitney U test results revealed a statistically significant difference between mean rating responses of Chinese and international teachers (U = 96, Z = -2.265, p = 0.024). Despite both groups having positive 21st century skills teaching knowledge, a significant difference existed between the two with international teachers possessing a stronger self-reported understanding.

I then compared the 21st century skills teaching knowledge posttest mean ratings of both participant groups. The 21st century skills teaching knowledge posttest mean ratings of Chinese participants (M = 4.12, SD = 0.58) and international participants (M = 4.26, SD = 0.54) reflected a slight growth in the Chinese group regarding 21st century skills teaching knowledge from the pretest but a slight decrease in the international group. The results from the comparison of these two groups using a Mann-Whitney U test revealed no statistically significant difference between mean rating responses of Chinese and international teachers (U = 162.5, Z = -0.230, p = 0.818) suggesting that the difference was reduced between the two groups. The decline in international participants' perceptions of their 21st century skills knowledge is the only noted decrease on any of the survey posttests. It is unclear why this decrease occurred, particularly in an area that was rated positively compared to other variables.

Interview data revealed that most Chinese and all international participants generally expressed a positive development in 21st century skills teaching knowledge, which was also supported by the survey data. There were a few Chinese participants (n = 3, 27.27%), however, who expressed that the information was either repeated for them or they still did not know how to apply the skills as noted previously. For example, one Chinese participant explained:

> After the program, I did get a better understanding of the skills. However, personally, I haven't had a [*sic*] quite strong opinion about it. Currently, I know what the skills are. Whether I am going to use them or not and how I am going to use them, I haven't got a clear answer for myself.

All other participants, both Chinese and international, expressed that their 21st century skills teaching knowledge improved as a result of the PD program experience. One international participant noted, “It kind of helped me to understand that you know the importance of marrying project-based learning that touches on these skills.” Another international participant explained how the program changed his thinking, saying:

> I think that I’m well prepared for the changing world, you know as we become more globally connected. Yeah, so I think that those - that kind of sums up sort of what I’ve gotten from this program. I’m happy for the fact that a 21st century skillset is a recognized skillset, and it kind of appeared we can see the world through it and education in general.

A Chinese participant elaborated on this idea of seeing the world differently due to the program’s 21st century skills information, explaining, “After I participated in this program, I have realized that what I need to do is not just educate students but [*sic*] also need to know what direction I am leading them to, what I can share with them.” Based on these responses and the earlier data from the 21st century skills research question, this was one of the most positive development areas as a result of the PD program. Triangulation of the quantitative and qualitative data revealed that both Chinese and international participants experienced similar growth in their 21st century skills teaching knowledge.

Summary of Findings

This study focused on technology integration among K-6 Chinese and international educators in a Chinese context. Specifically, it investigated how PD can work to improve educator skills to be successful with fostering students’ development of 21st century skills. The study’s intervention involved the implementation of an online, cross-curricular, technology-related PD program with a CoP to address this issue, specifically focusing on improving teacher technology self-efficacy, competency, and integration practices as well as teacher knowledge of 21st century skills. This chapter consisted of a discussion of the findings using a mixed methods data research design to respond to the seven research questions.

Participant statements highlighted a generally negative view of administrative support and technology school planning in their contexts, noting an absence of both. As principal and administrative leadership is an important supporting component for technology integration in K-12 schools (Chang, 2012; Dawson & Rakes, 2003; Li, 2006; Machado & Chung, 2015), this finding identified a key barrier in Chinese contexts. Additionally, participants' responses identified a lack of both past and present PD experiences for participants related to technology as well as other areas, which is consistent with findings from research on PD in the Chinese context (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007; Zhou et al., 2011). Infrastructure and technology tool access varied widely across contexts, allowing me to identify no apparent similarities between different settings while research literature identified it as a primary obstacle in Chinese schools (Law, 2007; Liang et al., 2008; Wenbin, 2012). Although participants also detailed technology support systems, staff, and budgeting as absent from most contexts, they described a generally positive culture toward technology in their schools with a few exceptions. Given this generally positive culture, the potential for technology integration exists in Chinese schools but faces many primary barriers that must be overcome.

Participation rates were low with the program and posed a validity issue for the study. Participation and engagement, which started relatively high in the initial session, declined with each progressive PD session, resulting in a lack of completion amongst participants. Matzat (2013) highlighted the need for increased active interaction in discussion groups and other activities as an issue with online communities. Despite this decline, enthusiasm and motivation remained high in the WeChat CoP, which emerged as the focal point of the program according to participants due to their ability to share and interact. From a situated learning perspective, Kearney (2015) and Lave and Wenger (1991) highlighted how educators can increase their learning through positive peer interactions and knowledge sharing, leading a more positive learning experience. Additionally, Wenger and colleagues (2002) detailed seven principles necessary to create a sense of “aliveness” in a PD community and maintain excitement, relevance, and value for participants (p. 50). This finding was of particular importance considering the high usage of WeChat in a Chinese context, potentially highlighting an area of focus for future PD efforts in this context and a manner in which to possibly prevent a lack of participation and attrition issues, a common occurrence in online PD (Russell et al., 2009). Additionally, participants maintained little implementation of the program’s content in their classrooms with many suggesting that they may employ it in the future when more time is available.

Despite this lack of participation, participants maintained a favorable view of the program, noting its high-quality content, resources, and support team. Participant statements highlighted several factors contributing to the lack of participation, including outside personal demands and work schedules, the PD program’s excessive workload, technical connection issues, and the communal impact of decreased participation. Seminal research from Darling-Hammond (2017), Desimone (2009), Desimone & Garet (2015), and Loucks-Horsley et al. (1996) highlighted these barriers as important areas of focus related to principles of effective PD. These key findings point toward the need for future research to consider a workload and length balance and a potential avenue to avoid engagement issues, which WeChat mitigated as noted previously. Additionally, the impact of decreased participation on the community is a critical finding supported by research literature (Henderson, 2007) as it suggests the need for online PD programs to have thorough, well-planned strategies to address this issue from the start. Participants suggested six areas of improvement for future PD programs, including (a) directly applicable classroom content, (b) more focused content based on student grades/ages, (c) less content in general, (d) necessary cultural adaptations for Chinese participants, (e) addition of a blended approach, and (f) methods to combat low participation. Of these six, research literature supported five, including directly applicable classroom content (Desimone & Garet, 2015; Donovan et al., 2007; Hu et al., 2014; Penuel et al., 2007), effective program workload balance (Darling-Hammond et al., 2017; Desimone, 2009; Desimone & Garet, 2015; Loucks-Horsley et al., 1996), culturally relevant PD (Avalos, 2011; Dai et al., 2011; Sang et al., 2012), and the positive benefits of a blended approach (Overbaugh & Lu, 2008; Owston et al., 2008), and methods to combat low participation (Keller, 1987; Matzat, 2013). I uncovered no clear association between technology self-efficacy and contextual factors based on the current data. It was not possible to draw a clear connection as contextual factors varied widely at different schools as did the level of technology self-efficacy of participants, making it challenging to link low or high technology self-efficacy to any particular contextual elements.

A comparison of pre- and post-intervention data with a paired sample revealed a statistically significant increase in participants' technology self-efficacy, but no significant improvement in technology competency, perceptions of technology integration, perceptions of PD, and 21st century skills knowledge. Participants statements supported the growth in their self-reported technology self-efficacy but noted that more hands-on, practical application experiences could increase it further. Responses highlighted the WeChat CoP as particularly important for technology competency because it allowed for a community space for sharing knowledge between technology novices and more experienced participants. This finding is reflective of previous research (e.g., Lave & Wenger, 1991; Wenger, 1998), which highlighted the importance of collegial interactions and legitimate peripheral participation in a CoP. Participants also expressed a general weariness with moving forward with technology integration without more practical experience. Social cognitive theory supports the importance of hands-on, authentic learning experiences to enhance learning and understanding with participants active in their education process and required to monitor their cognitive process and development while observing others and interacting with the environment (Desimone & Garet, 2015; Hu et al., 2014). Participant statements related to perceptions of PD, however, differed strongly from the quantitative data, expressing a more favorable impression of PD as a result of the program while also highlighting the workload as too heavy for such a short period. Similarly, participants' statements relative to 21st century skills knowledge were more positive than the survey results. In particular, participants described a subjective understanding of 21st century skills before the program.

A comparison of Chinese and international participants revealed no significant difference regarding teacher technology self-efficacy, perceptions of technology integration abilities, perceptions of PD, and 21st century skills knowledge. These findings were somewhat surprising, considering the research literature generally highlighted more negative background experiences for Chinese educators due to poor PD experiences (Ely, 1999; Hew & Brush, 2007; Wu et al., 2007; Zhang, 2007). Participants statements regarding perceptions of PD, however, did not reflect the quantitative data as a larger number of international participants expressed positive statements than Chinese participants. Chinese participants highlighted a lack of content focus in the PD program as well as little improvement of their skills as reasons behind their negative statements.

Overall, these findings describe a contextual environment that is facing multiple barriers to technology integration to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets. Participant statements and research literature are consistent on four key factors impacting technology integration in Chinese schools: infrastructure (Tan, 2010; Wan, 2012; Wenbin, 2012), user knowledge (Figg & Jaipal, 2011; Li et al., 2012; Mishra & Koehler, 2006; Rohaan et al., 2012; Sang et al., 2011), school management and support (Chang, 2012; Li, 2006; Machado & Chung, 2015), and educational philosophy (Kim et al., 2013; Lee et al., 2013; Liu & Feng, 2015). The barriers described in the data coincided with similar obstacles highlighted in the needs assessment findings as well as Chapter One literature review and conceptual model (see Figure 1.2), suggesting school contexts must face multiple primary issues before achieving effective technology integration. Although the PD program was somewhat successful in improving technology self-efficacy, perceptions of technology integration abilities, perceptions of PD, and 21st century skills knowledge, the lack of participant participation, engagement, and completion of the program negatively impacted these potential benefits. Ongoing PD support emerged as necessary to improve participants abilities, and future research should consider the enhanced integration of practical and applicable content for educators to apply in their classrooms.

Limitations

There are several limitations in addition to the previously noted design limitations in Chapter Four, including the sample size and composition of participants, the multitude of school environments from which participants originated, the limited timeframe of the intervention, the technology limitations encountered during the intervention, and the limited completion of the intervention by participants. The small sample size impacts the generalizability of the findings. Although the intervention original sought to recruit 60 participants, this recruitment proved challenging, especially with the high attrition attributed to the online PD programs. A total of 81 participants initially expressed interest in the program, which our research team attempted to collect consent protocols from and engage in the necessary pretesting before starting the intervention. Of these 81, only 47 participants completed the necessary paperwork and steps to start the intervention, four dropped out, and six did not complete the required posttests resulting in complete data from 37 participants. Additionally, I had hoped to have a relatively higher participation rate from Chinese participants (n = 20, 54.05%) than international participants (n = 17, 45.95%) but the numbers were somewhat equal. Although the participants represented a full range of primary school grade levels, kindergarten (n = 17, 45.95%) was much more strongly represented than the other grades. Also, the voluntary nature of the program guaranteed that a much more enthusiastic cross-section of participants related to the subject matter would be selected than is potentially representative of the general population.

Second, as the contextual interviews noted, participants originated from a wide variety of contexts with different characteristics related to technology integration and use, including administrative support, infrastructure, technology support systems, school culture, past and current technology PD, budget, and parental impact. Although one may view this diversity as a potential limitation due to an inability to control different contextual variables impacting participants as well as their varied experiences related to technology integration, it also highlights a potential strength regarding the variance of data collected from diverse populations and school settings. This diversity within the participant sample described the wide variation of conditions existing in different international school contexts in China, identifying a host of primary issues that differ from school to school and therefore highlighting the complexity of the problem technology integration faces in Chinese schools.

Third, the timeframe of the intervention was quite limited, taking place over seven weeks. This short amount of time is challenging for PD to have a long-lasting impact on participants regarding their technology self-efficacy, technology competence, technology integration within the classroom, and knowledge of 21st century skills. Although this timeframe provided several hours of engagement well over the minimum highlighted in the research literature as able to positively influence on participants (Davidson et al., 2009; Yoon et al., 2007), the limited participation and engagement makes it difficult to tell if the changes from beginning to the end of the PD will be maintained over time and if the program will lead to positive, longitudinal benefits.

Fourth, as highlighted in the data analysis, the self-reported technology issues encountered by some of the participants impacted the intervention's ability to be successful as it limited their access to material found on the Blackboard Learn online PD platform. Although this limitation was challenging to avoid as it was extensively tested for in advance by the program team with no issues uncovered, it represents a future challenge for any online platform system in China. Participants will each have unique technical capabilities (e.g., system, browser, telecommunications provider, etc.) depending on their location in the country, and the heightened online security in this context may severely limit individuals' abilities to access this type of support network for professional education training and improvement. For a scalable, robust online PD system to be successful in China, these fundamental technical challenges will require attention as they not only limit access but also potentially contribute to increased attrition and reduced participation, motivation, and engagement. Although this could improve access for participants living in China, it will also potentially limit the language accessibility for international participants as well as functions available on the system. One must carefully weigh these considerations before making any selection.

Finally, the low percentage of completion of the intervention represents a considerable limitation. The decline in participation and engagement throughout the program occurred due to a variety of factors (e.g., lack of motivation and enthusiasm, outside schedules, heavy program workload, connection issues, etc.). This issue resulted in an incomplete data set from participants and therefore impacted the results of the study. Current Chinese PD programs sometimes do not address the needs of K-12 teachers and employ full-day, lecture-based approaches, which are the prevalent method of existing PD (Wu et al., 2007; Zhang, 2007). These lectures are often ineffective, presenting few opportunities for actual implementation and use of strategies by the participants (Wu et al., 2007; Zhang, 2007). This approach is much different from the methodology of the online PD intervention coupled with the WeChat CoP and therefore represented a familiarity barrier for some participants to become accustomed to the online, self-motivated approach. As noted in Chapter One, many Chinese teachers' epistemological views originate from concepts of Confucianism, a perspective of knowledge acquisition that is a consequence of an authoritative, lecture-based, behaviorist approach to education, which is when an expert provides knowledge directly to novice pupils (Lee et al., 2013; Li et al., 2012; Wang & Du, 2014). This modality of training forms the root of this lecture-based approach to PD in China and represents an obstacle for teachers to overcome in their learning beliefs. However, considering this limited completion, positive results attained in some areas suggest the potential for the program to have a stronger beneficial impact on participant learning if it can maintain engagement throughout the entire program process. While this remains a limitation, it still hints toward the possibility of the positive impact PD can have if participants stay engaged.

Implications for Research and Policy

There are four implications for future research including (a) considerations for engagement and program completion, (b) sufficient workload for online participants and its delivery to them, (c) the ability to provide a more longitudinal PD experience allowing for practical application of content the ability to provide a more longitudinal PD experience allowing for practical application of content and more benefits for participants and research, and (d) the need for a more focused and organized PD experience, and (e) considerations for social desirability in a Chinese context. Additionally, I have included broad policy considerations and implications. These implications emerged from the mixed methods data collected during the PD program and represent key implications for the implementation of any PD program in a Chinese as well as an international context.

First, it is important in the future to ensure participants remain engaged, participate in all activities, and complete the entire program to guarantee high-quality, accurate data results as well as achieve the most comprehensive benefits for them. Although I had predicted recruitment as a potential issue, I did not expect the high attrition and drop off in participation before the actual intervention started, nor the ongoing decline in engagement throughout the program. Participants, as well as the research literature (Henderson, 2007), described the negative and demotivating impact of declining participation on the entire PD cohort, including those highly engaged and identified it as an important issue to address in any PD program. Despite low participation in the online Blackboard Learn platform, participants noted high engagement in the WeChat CoP, perceiving it as valuable and beneficial to their learning experiences. In the PD literature review, Wenger (2002) highlighted that voluntary CoP success depends on the maintenance of excitement, relevance, and value for participants related to seven principles that foster aliveness. These seven principles included a design for evolving change and needs, maintaining an open dialogue, inviting different levels of participation, developing public and private discussion spaces, focusing on learning value, combining familiarity and excitement, and creating a communal rhythm of sharing and participation (Wenger, 2002). As WeChat is a highly popular social and work online communication platform in China, it potentially represents an avenue future research could explore to maintain Wenger's sense of aliveness and therefore avoid low participation and attrition issues. It could also represent a key channel to provide PD opportunities to participants in a Chinese context in the future. Additionally, future PD could provide some certificate that may encourage and motivate participants to engage in the full process to completion as suggested by participants. If an authorized educational organization sanctioned the PD with a certificate, participants might be incentivized to finish the program, and it may add value to the overall program. As online PD often suffers from attrition (Russell et al., 2009), ongoing engagement is a fundamental aspect that should be planned for and addressed before a PD program begins.

Second, multiple participants in the intervention PD program commented on each session having too much workload based on their full-time schedules as educators. As a program administrator, it is essential to consider the applicability of the content and the amount of content a program's specific participants can handle taken into consideration the timeframe given as well as participants' outside schedules. Darling-Hammond (2017), Desimone (2009), Desimone & Garet (2015), and Loucks-Horsley et al. (1996) highlighted adequate workload as a principle of effective PD, and program administrators need to carefully balance this workload with their program duration and goals to achieve effective results. As participants in the PD program noted higher engagement with WeChat than with the online platform Blackboard, it is also necessary to consider how to deliver this work to participants. Participant statements highlighted that content provided via WeChat was more accessible and flexible due to the mobile-friendly nature of the application. Shohel and Banks (2012) also supported the value of mobile devices for PD content delivery. Therefore, future research needs to consider not only a balanced workload but also how that workload reaches its online participants. The PD program duration should be doubled, providing two weeks for each session instead of one to have a more long-term beneficial impact on participants. This alteration would modify the amount of heavy workload participants highlighted each week and balance more with their full-time teaching schedules. It would also still provide a minimum number of hours of PD to be effective based on current research (Davidson et al., 2009; Yoon et al., 2007). Finally, to offer a more thorough comparison of different PD approaches, three different groups of participants would coincide. One would involve only the Blackboard Learn platform, one would in involve just the WeChat CoP, and the final group would integrate both Blackboard Learn and WeChat. This multi-pronged approach would allow a direct comparison of the benefits and disadvantages of each PD modality and lead to more in-depth, comprehensive data.

Third, the intervention PD program had a relatively short duration. More effective results may emerge from an ongoing PD experience, allowing participants to have more time to use and implement the technology integration strategies and practices with their students. Participants statements repeatedly stressed the need for more authentic, practical experiences to enhance their skills and abilities, and a more extended duration PD program would allow for this application, evaluation, and feedback process in their actual classrooms while they are still engaged as participants of the program. Multiple authors (Desimone, 2009; Donovan et al., 2007; Yan & He, 2012; Zhan, 2008) stress the importance of these practical experiences to enhance teacher practices and strategies as well. This longitudinal approach to the research would also allow modification of the design to include classroom observations as well as a potential collection of student data to determine whether the PD program has an impact on student achievement as the revised conceptual model (see Figure 3.1) suggests. It could also integrate a blended format with an initial workshop and online, follow-up modules to regularly support and reinforce learning. As Overbaugh and Lu (2008) highlighted, blended PD can lead to teacher growth which lasts for months after the conclusion of the program, maintaining the longitudinal benefits of PD delivered in a blended format with online follow-up modules. A more sustained intervention may potentially provide development for participants in all of the investigated variables, therefore offering stronger evidence for this model.

Fourth, as highlighted by many of the participants during the interviews, future research involving a technology-focused PD and CoP program could benefit from a more focused approach, both in subject matter as well as in participant selection. Reeves and Pedulla (2013) and Vavasseur and Kim MacGregor (2008) highlighted the importance of PD being context-relevant, noting that it made content more applicable for participants and therefore resulted in higher motivation and engagement. Through a more focused, single topic approach relevant to their daily practices, participants would receive a more comprehensive professional learning experience that could ideally have a hands-on, workshop-related component to enhance participants' ability to implement in the classroom (Desimone, 2009; Donovan et al., 2007; Yan & He, 2012; Zhan, 2008). Additionally, participants would benefit from being grouped more specifically by grade levels instead of in a broad range of grade levels. By consolidating more proximal grades, content can be more targeted for the specific needs of the participants, and the program could avoid presenting material that may not necessarily be relevant to all participants, a potential factor leading to lower motivation and attrition.

Fifth, the social desirability findings from the intervention study did not align with Chapter One. This result was surprising based on the responses provided by the Chinese needs assessment study participants, which tended to offer socially acceptable responses on survey questions. This finding suggests that the Chinese needs assessment study participants were more likely to give a socially desirable answer to program administrators they were directly familiar within their context as participants in the intervention study were recruited from multiple unfamiliar settings. As the needs assessment described, the Chinese participants may have overestimated their technology self-efficacy due to a social desirability issue that possibly related to Chinese culture and collectivism highlighted in Chapter One (Zhang, 2007). In Chinese culture, it is common for individuals to provide what are viewed as socially acceptable and desirable responses to avoid offense or disagreement, aligning with ideas of harmony in social harmony in collectivism (Zhang, 2007). This finding suggests researchers may need to be cautious with data from Chinese participants when working in their context and consider the cultural implications of responses to have a more in-depth understanding of the data provided.

Finally, there are several policy implications for higher engagement. Future PD could provide a certificate that may encourage and motivate participants to engage in the full process to completion as suggested by participants. If an authorized educational organization sanctioned the PD with a certificate, participants might be incentivized to finish the program, and it may add value to the overall program. As online PD often suffers from attrition (Russell et al., 2009), ongoing engagement is a fundamental aspect that should be planned for and addressed before a

PD program begins. Additionally, future PD research should bridge the gap between infrastructure available in the classroom and the school for technology integration. As the majority of participants noted having access to a projector, this issue could be improved through the widespread use of dongles in Chinese schools that connect phones directly to a projector. This approach could avoid problems encountered with WiFi in campuses and provide all educators a rudimentary, cost-efficient approach to technology integration. Also, training videos focused on technology integration demonstrations could be widely distributed to educators in China via WeChat and their phones. These videos could provide a more clear, step-by-step process on how to integrate various technologies within the classroom. Finally, it is important to incorporate observations of usage by teachers to identify issues they are encountering and improve their integration strategies. These observations could be executed by a PD administrator or technology integration specialist, providing educators direct reflective feedback on any issues.

Conclusion

As Baldwin (1963) highlighted in his article "A Talk to Teachers" in *The Saturday Review*, "It is your responsibility to change society if you think of yourself as an educated person" (para. 19). Throughout my educational journey, I count myself as lucky to have been able to interact and work in diverse, international contexts. The problems facing the Chinese education system, particularly related to technology integration to foster the development of 21st century skills in students, are significant. And, unfortunately, there is no simple, universal solution. Education leaders, particularly those like myself who are based in multicultural environments, need to consider, understand, and embrace the crucial role they embody as catalysts of positive change. This positive change impacts a vast network of key individuals, including, but not limited to students, families, fellow educators, and surrounding communities.

As leaders in our fields, when we possess the metaphorical keys of knowledge and experience to tackle a complex challenge, we must embrace that responsibility and work diligently to open the windows of awareness to anyone within our network that we can potentially impact positively.

The future challenges facing students in today's classrooms are unpredictable and unknowable. As educators, the only manner in which we can best prepare them for the future is to equip them with the necessary 21st century skills, such as creativity, critical thinking, communication, and collaboration abilities, to be better able to face the challenges of tomorrow and be successful in the global economy. At the root of this challenge, PD represents a fundamental resource required by all educators to help them learn, grow, and improve to support their students better and transfer those benefits to them. With the rise of online educational platforms and considering the massive population size of China, it is important to identify financially feasible and scalable opportunities to reach as many educators as possible and provide them the professional learning support they desperately need. An online approach to PD offers this window of opportunity as a foundational pathway to provide teacher and therefore student improvement nationwide in China.

As with many things, change and transformation take time, especially when one is working to improve the learning journey of both teachers and students. When moving forward with such a mission, it is crucial to not only target immediate, short-term results but to endeavor to enhance the long-term development of a highly complex educational system that will foster and guide a nation's children, as well as those educating those children, on transformational educational journeys. As development is a long process which requires fortitude, patience, and resilience, one must take incremental steps to improve and always keep one thought in mind: "What can I do better tomorrow?"

References

Alamin, A. A., Shaoqing, G., & Le, Z. (2015). The development of educational technology policies (1996-2012): Lessons from China and the USA. *International Education Studies, 8*(6), 142-150. doi:10.5539/ies.v8n6p142

An, Y., & Reigeluth, C. (2014). Creating technology-enhanced, learner-centered classrooms: K-12 teachers' beliefs, perceptions, barriers, and support needs. *Journal of Digital Learning in Teacher Education, 28*, 54-62. doi:10.1080/21532974.2011.10784681

Association for Career and Technical Education. (2010). *Up to the challenge: the role of career and technical education and 21st century skills in college and career readiness*. Retrieved from http://www.p21.org/

Avalos, B. (2011). Teacher professional development in *Teaching and Teacher Education* over ten years. *Teaching and Teacher Education, 27*(1), 10–20. doi:10.1016/j.tate.2010.08.007

Bahng, E., & Lee, M. (2017). Learning experiences and practices of elementary teacher candidates on the use of emerging technology: A grounded theory approach. *International Electronic Journal of Elementary Education, 10*, 225–241. doi:10.26822/iejee.2017236118

Baldwin, J. (1963, December 21). A talk to teachers. *The Saturday Review*. Retrieved June 30, 2018, from http://richgibson.com/talktoteachers.htm

Bamberger, M., Tarsilla, M., & Hesse-Biber, S. (2016). Why so many "rigorous" evaluations fail to identify unintended consequences of development programs: How mixed methods can contribute. *Evaluation and Program Planning, 55*, 166-162. doi:10.1016/j.evalprogplan.2016.01.001

Bandura, A. (1977a). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*, 191–215. doi:10.1037/0033-295x.84.2.191

Bandura, A. (1977b). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1978). The self system in reciprocal determinism. American Psychologist, 33(4), 344–358. doi:10.1037/0003-066x.33.4.344

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*, 122-147. doi:10.1037/0003-066x.37.2.122

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1994). Self-efficacy. In VS Ramachaudran (Ed.), *Encyclopedia of human behavior* (Vol. 4, pp. 71-81). New York, NY: Academic Press. (Reprinted in H. Friedman [Ed.], *Encyclopedia of mental health*. San Diego, CA: Academic Press, 1998). Retrieved from https://www.uky.edu/~eushe2/Bandura/Bandura1994EHB.pdf

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman. doi:10.5860/choice.35-1826

Baranowski, T. & Stables, G. (2000). Process evaluations of the 5-a-day projects. *Health Education and Behavior, 27*, 157-166. doi:10.1177/109019810002700202

Barbour, M. (2011). The promise and the reality: Exploring the research on virtual schooling. In M. Koehler & P. Mishra (Eds.), *SITE 2011 Proceedings: Society for Information Technology & Teacher Education* (pp. 3433-3442). Chesapeake, VA: Association for the Advancement of Computers in Education.

Bass, B. M. (1985). Leadership and performance beyond expectation. New York, NY: Free Press. doi:10.1002/hrm.3930250310

Bass, B. M. (1999). Two decades of research and development in transformational leadership. *European Journal of Work and Organizational Psychology, 8*(1), 9-32. doi:10.1080/135943299398410

Becker, H. J. (1994). How exemplary computer using teachers differ from other teachers: Implications for realizing the potential of computers in schools. *Journal of Research on Computing in Education, 26*, 291–321. doi:10.1080/08886504.1994.10782093

Bell, R., Maeng, J. L., & Binns, I. C. (2013). Learning in context: Technology integration in a teacher preparation program informed by situated learning theory. *Journal of Research in Science Teaching, 50*, 348-379. doi:10.1002/tea.21075

Bellanca, J. A., & Brandt, R. (Ed.). (2011). *21st century skills: Rethinking how students learn.* Bloomington, IN: Solution Tree Press.

Blitz, C. L. (2013). Can online learning communities achieve the goals of traditional professional learning communities? What the literature says. REL 2013-003. *Regional Educational Laboratory Mid-Atlantic.*

Bo-nai, F., & Xiong-xiang, L. (2006). A study on the rate of contribution of education investment to the economic growth in China. *Frontiers of Education in China, 4*, 521-532. doi:10.1007/s 11516-006-0027-y

Booth, S. E., & Kellogg, S. B. (2015). Value creation in online communities for educators. *British Journal of Educational Technology, 46*, 684–698. doi:10.1111/bjet.12168

Borko, H. (2004). Professional development and teacher learning: Mapping the terrain. *Educational Researcher, 33*(8), 3–15. doi:10.3102/0013189x033008003

Brinkerhoff, J. (2006). Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices. *International Society of Technology in Education, 39*(1), 22-43, doi:10.1080/15391523.2006.10782471

Brinkerhoff, J., Ku, H., Glazewski, K. & Brush, T. (2002). *Development, results and validation of technology integration surveys for preservice and practicing teachers*. Presentation at the meeting of the Association for Educational Communications and Technology, Atlanta, GA.

Bronfenbrenner, U. (1994). Ecology models of human development. In T. N. Postlewaite & Husen, T. (Eds.), *International encyclopedia of education* (2nd ed., Vol. 3, pp. 1643-1647). Oxford, England: Elsevier.

Bronfenbrenner, U., & Morris, P. A. (2006). The bioecological model of human development. *Handbook of Child Psychology.* doi:10.1002/9780470147658.chpsy0114

Brush, T., & Saye, J. W. (2009). Strategies for preparing preservice social studies teachers to integrate technology effectively: Models and practices. *Contemporary Issues in Technology and Teacher Education, 9*(1), 46–59. Retrieved from http://www.citejournal.org/

Cennamo, K. S., Ross, J. D., & Ertmer, P. A. (2010). *Technology integration for meaningful classroom use: A standards-based approach.* Belmont, CA: Wadsworth, Cengage Learning.

Chan, C. K., & Rao, N. (2009). *Revisiting the Chinese learner: Changing contexts, changing education*. Dordrecht: Springer. doi:10.1007/978-90-481-3840-1

Chan, C. K. K., & Sachs, J. (2001). Children's belief about learning and understanding of science texts. *Contemporary Educational Psychology, 26*, 192–210. doi:10.1006/ceps.1999.1045

Chan, K.W. & Elliot, R.G. (2004). Relational analysis of personal epistemology and conceptions about teaching and learning. *Teaching and Teacher Education, 20*, 817-831. doi:10.1016/j.tate.2004.09.002

Chang, I. (2012). The effect of principals' technological leadership on teachers' technological literacy and teaching effectiveness in Taiwanese elementary schools. *Journal of Educational Technology & Society, 15*, 328-340. Retrieved from http://www.ifets.info

Chen, C. (2008). Why do teachers not practice what they believe regarding technology integration? *The Journal of Educational Research, 102*(1), 65-75. doi:10.3200/joer.102.1.65-75

Cheung, H. (2008). Teacher efficacy: A comparative study of Hong Kong and Shanghai primary inservice teachers. *The Australian Educational Researcher, 35*(1), 103-123. doi:10.1007/bf03216877

Chikasanda, V. K. M., Otrel-Cass, K., Williams, J., & Jones, A. (2013). Enhancing teachers' technological pedagogical knowledge and practices: A professional development model for technology teachers in Malawi. *Journal of Technology & Design Education, 23*, 597-622. doi:10.1007/s10798-012-9206-8

Claesgens, J., Rubino-Hare, L., Bloom, N., Fredrickson, K., Henderson-Dahms, C., Menasco, J., & Sample, J. (2013). Professional development integrating technology: Does delivery format matter? *Science Educator, 22*(1), 10-18. Retrieved from http://www.nsela.org/publications/science-educator-journal

Clarke, D. J. (1997). Chapter 7: Studying the Classroom Negotiation of Meaning: Complementary Accounts Methodology. *Journal for Research in Mathematics Education. Monograph, 9*, 98. doi:10.2307/749949

Clarke, D. (Ed.). (2002). *Perspectives on Practice and Meaning in Mathematics and Science Classrooms.* Mathematics Education Library. doi:10.1007/0-306-47228-7

Clarke, D. J., Carlin, P., & Peter, A. (1992). *Professional development and the secondary mathematics teacher: A case study.* Research Report 6. Oakleigh, Victoria: Mathematics Teaching and Learning Centre. Retrieved from https://www2.merga.net.au/

Clarke, D., & Hollingsworth, H. (2002). Elaborating a model of teacher professional growth. *Teaching and Teacher Education, 18*, 947–967. doi:10.1016/s0742-051x(02)00053-7

CONTEXT (2017). *Educating future global leaders* [Brochure]. Beijing, China: n.p.

Corbin, J., & Strauss, A. (Eds.). (2008). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks, CA: Sage.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. Journal of Applied Psychology, *78*(1), 98–104. doi:10.1037/0021-9010.78.1.98

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research.* Thousand Oaks, CA: Sage.

Curwood, J. S. (2013). Applying the design framework to technology professional development. *Journal of Digital Learning in Teacher Education, 29*, 89-96. doi:10.1080/21532974.2013.10784710

Dabner, N., Davis, N., & Zaka, P. (2012). Authentic project-based design of professional development for teachers studying online and blended teaching. *Contemporary Issues in Technology and Teacher Education, 12*(1). 71-114. Retrieved from http://www.citejournal.org/

Dai, D. Y., Gerbino, K. A., & Daley, M. J. (2011). Inquiry-based learning in China: Do teachers practice what they preach, and why? *Frontiers of Education in China, 6*(1), 139-157. doi:10.1007/s11516-011-0125-3

Darling-Hammond, L. (1999). Educating teachers: The academy's greatest failure or its most important future? *Academe, 85*(1), 26-33. doi:10.2307/40251715

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (with Espinoza, D.). (2017). *Effective teacher professional development.* Palo Alto, CA: Learning Policy Institute. Retrieved from https://learningpolicyinstitute.org

Davidson, M. R., Fields, M. K., & Yang, J. (2009). A randomized trial study of a preschool literacy curriculum: The importance of implementation. *Journal of Research on Educational Effectiveness, 2*(3), 177–208. doi:10.1080/19345740902770028

Dawson, C., & Rakes, G. C. (2003). The influence of principals’ technology training on the integration of technology into schools. *Journal of Research on Technology in Education, 36*(1), 29-49. doi:10.1080/15391523.2003.10782401

Deng, F., Chai, C., Tsai, C., & Lee, M. (2014). The relationships among Chinese practicing teachers’ epistemic beliefs, pedagogical beliefs and their beliefs about the use of ICT. *Educational Technology & Society, 17*, 245-256. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eft&AN=96172823&site=ehost-live&scope=site

Desimone, L. M. (2009). Improving impact studies of teachers’ professional development: Toward better conceptualizations and measures. *Educational Researcher, 38*, 181–199. doi:10.3102/0013189x08331140

Desimone, L. M., & Garet, M. S. (2015). Best practices in teachers' professional development in the United States. *Psychology, Society, & Education, 7*, 252-263. doi:10.25115/psye.v7i3.515

Donovan, L., Hartley, K., & Strudler, N. (2007). Teacher concerns during initial implementation of a one-to-one laptop initiative at the middle school level. *Journal of Research on Technology in Education, 39*, 263–286. doi:10.1080/15391523.2007.10782483

Dusenbury, L., Brannigan, R., Falco, M., & Hansen, W. B. (2003). A review of research on fidelity of implementation: Implications for drug abuse prevention in school settings. *Health Education Research, 18*, 237–256. doi:10.1093/her/18.2.237

Eckert, P., & McConnell-Ginet, S. (1992). Think practically and look locally: Language and gender as community-based practice. *Annual Review of Anthropology, 21*(1), 461–488. doi:10.1146/annurev.an.21.100192.002333

Ely, D. P. (1999). Conditions that facilitate the implementation of educational technology innovations. *Educational Technology*, *39*, 23–27. doi:10.1080/08886504.1990.10781963

Ertmer, P. A. (2005). Teacher pedagogical beliefs: The final frontier in our quest for technology integration? *Educational Technology Research and Development*, 53(4), 25–39. doi:10.1007/bf02504683

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education*, *42*, 255-284. doi:10.1080/15391523.2010.10782551

Fees, B., Hoover, L., & Zheng, F. (2014). Chinese kindergarten teachers' perceived changes in their teaching philosophies and practices: A case study in a university-affiliated program. *International Journal of Early Childhood, 46*, 231-252. doi:10.1007/s13158-014-0109-6

Fereday, J., & Muir-Cochrane, E. (2006). Demonstrating rigor using thematic analysis: A hybrid approach of inductive and deductive coding and theme development. International *Journal of Qualitative Methods, 5*(1), 1-11. Retrieved from http://www.ualberta.ca/~iiqm/backissues/5_1/pdf/fereday.pdf

Figg, C., & Jaipal, K. J. (2011). Exploring teacher knowledge and actions supporting technology-enhanced teaching in elementary schools: Two approaches by pre-service teachers. *Australasian Journal of Educational Technology, 27*, 1227-1246. doi:10.14742/ajet.914

Fishman, B., Konstantopoulos, S., Kubitskey, B., Vath, R., Park, G., Johnson, H., & Edelson, D. (2013). Comparing the impact of online and face-to-face professional development in the context of curriculum implementation. *Journal of Teacher Education, 64,* 426-438. doi:10.1177/0022487113494413

Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal, 38*, 915-945. doi:10.3102/00028312038004915

Gentry, J. E., Baker, C., Thomas, B. D., Whitfield, C., & Garcia, L. (2014). Transforming technology integration: An instrument to measure educator's self-efficacy for modeling 21st-century skills. *National Teacher Education Journal, 7*(3), 31-38. Retrieved from www.ntejournal.com/

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory.* London, England: Weidenfield & Nicolson.

Greeno, J. G. (1997). On claims that answer the wrong questions. *Educational Researcher, 26*(1), 5-17. doi:10.3102/0013189x026001005

Gu, X., Zhu, Y., & Guo, X. (2013). Meeting the "digital natives": Understanding the acceptance of technology in classrooms. *Educational Technology & Society, 16(1)*, 392–402. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=85178218&site=ehost-live&scope=site

Guo, K. L., & Yong, Y. (2013). Policies and Practices of Professional Development in China: What do Early Childhood Teachers Think? *Australian Journal of Teacher Education, 38*(6), 88-102. doi:10.14221/ajte.2013v38n6.4

Guskey, T. R. (1986). Staff development and the process of teacher change, *Educational Researcher,* 15(5), 5-12. doi:10.3102/0013189x015005005

Guskey, T. R. (2002). Professional development and teacher change. *Teachers and Teaching, 8*, 381-391. doi:10.1080/135406002100000512

Guskey, T. R. (2000). *Evaluating professional development.* Thousand Oaks, CA: Corwin Press.

Guskey, T.R., & Yoon, K.S. (2009). What works in professional development? *Phi Delta Kappan, 90*, 495-500. doi: 10.1177/003172170909000709.

Henderson, M. (2007). Sustaining online teacher professional development through community design. *Campus-Wide Information Systems, 24*(3), 162-173. doi:10.1108/10650740710762202

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research and Development*, *55*, 223–252. doi:10.1007/s11423-006-9022-5

Hollingsworth, H. (1999). *Teacher professional growth: A study of primary teachers involved in mathematics professional development.* Ph.D. thesis, Deakin University, Burwood, Victoria, Australia. Retrieved from http://dro.deakin.edu.au/

Holmes, A., Signer, B., & MacLeod, A. (2010). Professional development at a distance. *Journal of Digital Learning in Teacher Education, 27*(2), 76-85. doi:10.1080/21532974.2010.10784660

Hu, B. Y., Zhou, Y., & Li, K. (2014). Pinpointing Chinese early childhood teachers' professional development needs through self-evaluation and external observation of classroom quality. *Journal of Early Childhood Teacher Education, 35*, 54-78. doi:10.1080/10901027.2013.874386

International Society for Technology in Education. (2008). *International Society for Technology in Education (ISTE) Standards for Teachers: National Educational Technology Standards for Teachers.* Retrieved from http://www.iste.org/docs/pdfs/20-14_ISTE_Standards-T_PDF.Pdf

Jackson, B., Larzelere, R., St. Clair, L., Corr, M., Fichter, C., & Egertson, H. (2006). The impact of HeadsUp! Reading on early childhood educators' literacy practices and preschool children's literacy skills. *Early Childhood Research Quarterly, 21*, 213–226. doi:10.1016/j.ecresq.2006.04.005

Jayatilleke, B. G., Kulasekara, G. U., Kumarasinha, M. B., & Gunawardena, C. N. (2017). Implementing the first cross-border professional development online course through international e-mentoring: Reflections and perspectives. *Open Praxis, 9*(1), 31-44. doi:10.5944/openpraxis.9.1.461

Jensen, B., Sonnemann, J., Roberts-Hull, K., & Hunter, A. (2016). *Beyond PD: Teacher professional learning in high-performing systems.* Washington, DC: National Center on Education and the Economy. Retrieved from http://www.ncee.org

Jia, Y., Oh, Y. J., Sibuma, B., LaBanca, F., & Lorentson, M. (2016). Measuring twenty-first century skills: Development and validation of a scale for in-service and pre-service teachers. *Teacher Development, 20*, 229-252. doi:10.1080/13664530.2016.1143870

JohnBull, R. M. (2017). *Teacher efficacy*. Johns Hopkins University. Retrieved from https://connect.johnshopkins.edu/mbslsession3rjm/

JohnBull, R. M., Hardiman, M., & Rinne, L. (2013, April). *Professional development effects on teacher efficacy: Exploring how knowledge of neuro- and cognitive sciences changes beliefs and practices.* Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed method research: A research paradigm whose time has come. *Educational Researcher, 33*(7), 14-26. doi:10.3102/0013189X033007014

Jonassen, D. H., Howland, J., Moore, J., & Marra, R. M. (2003). *Learning to solve problems with technology: A constructivist perspective* (2nd ed.). Upper Saddle River, NJ: Pearson.

Jingtao, Z., Yuanyuan, F., & Xiaoling, M. (2010). The latest progress report on ICT application in Chinese basic education. *British Journal of Educational Technology, 41*, 567-573. doi:10.1111/j.1467-8535.2010.01083.x

Kagan, D. M. (1992). Implications of research on teacher belief. *Educational Psychologist, 27*, 65–90. doi:10.1207/s15326985ep2701_6

Kanaya, T., Light, D., & Culp, K. M. (2005). Factors influencing outcomes from a technology-focused professional development program. *Journal of Research on Technology in Education, 37*, 313-329. doi:10.1080/15391523.2005.10782439

Kay, K., & Greenhill, V. (2010). Twenty-first century students need 21st century skills. In *Bringing schools into the 21st century*, 41-65. Netherlands: Springer. doi:10.1007/978-94-007-0268-4_3

Kearney, S. (2015). Reconceptualizing beginning teacher induction as organizational socialization: A situated learning model. *Cogent Education, 2*(1), 1-11. doi:10.1080/2331186X.2015.1028713

Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of Instructional Development, 10*(3), 2-10. doi:10.1007/BF02905780

Kim, C., Kim, M., Lee, C., Spector, J. M., & DeMeester, K. (2013). Teacher beliefs and technology integration. *Teaching and Teacher Education, 29*, 76-85. doi:10.1016/j.tate.2012.08.005

Kim, M., & Cavas, B. (2013). Legitimate peripheral participation of pre-service science teachers: Collaborative reflections in an online community of practice, Twitter. *Science Education International, 24*, 306-323. Retrieved from http://icaseonline.net

Koehler, M. J., & Mishra, P. (2005). What happens when teachers design educational technology? The development of technological pedagogical content knowledge. *Journal of Educational Computing Research, 32*(2), 131–152. doi:10.2190/0ew7-01wb-bkhl-qdyv

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education (CITE Journal),* *9*(1), 60–70. Association for the Advancement of Computing in Education (AACE). Retrieved from https://www.learntechlib.org/p/29544/

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *Journal of Education, 193*(3), 13–19. doi:10.1177/002205741319300303

Kurland, H., Peretz, H., & Hertz-Lazarowitz, R. (2010). Leadership style and organizational learning: The mediate effect of school vision. *Journal of Educational Administration, 48*(1), 7-30. doi:10.1108/09578231011015395

Kurt, S. & Ciftci, M. (2012). Barriers to teachers' use of technology. *International Journal of Instructional Media, 39*, 225-238. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eue&AN=78855034&site=ehost-live&scope=site

Lave, J. (1988). *Cognition in practice: Mind, mathematics and culture in everyday life.* Cambridge, UK: Cambridge University Press.

Lave, J. (1991). Situating learning in communities of practice. *Perspectives on socially shared cognition, 2*, 63-82. doi:10.1037/10096-003

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, UK: Cambridge University Press.

Law, W. (2007). Legislation and educational change: The struggle for social justice and quality in China's compulsory schooling. *Education and the Law*, *19*, 177-199. doi:10.1080/09539960701751493

Law, Y., Chan, C., & Sachs, J. (2008). Beliefs about learning, self-regulated strategies and text comprehension among Chinese children. *British Journal of Educational Psychology, 78*, 51-73. doi:10.1348/000709907X179812

Lawless, K. A., & Pellegrino, J. W. (2007). Professional development in integrating technology into teaching and learning: Knowns, unknowns, and ways to pursue better questions and answers. *Review of Educational Research, 77*, 575-614. doi:10.3102/0034654307309921

Lee, J., Zhang, Z., Song, H., & Huang, X. (2013). Effects of epistemological and pedagogical beliefs on the instructional practices of teachers: A Chinese perspective. *Australian Journal of Teacher Education, 38*(12), 119-146. doi:10.14221/ajte.2013v38n12.3

Li, H. (2006). Integrating information and communication technologies into the early childhood curriculum: Chinese principals' views of the challenges and opportunities. *Early Education and Development, 17*, 467-487. doi:10.1207/s15566935eed1703_7

Li, Q. (2007). Student and teacher views about technology: A tale of two cities? *Journal of Research on Technology in Education, 39*, 377-397. doi:10.1080/15391523.2007.10782488

Li, H., Rao, N., & Tse, S. K. (2012). Adapting Western pedagogies for Chinese literacy instruction: Case studies of Hong Kong, Shenzhen, and Singapore preschools. *Early Education and Development, 23*, 603-621. doi:10.1080/10409289.2010.536441

Li, X., Chu, S., Ki, W., & Woo, M. (2012). Using a wiki-based collaborative process writing pedagogy to facilitate collaborative writing among Chinese primary school students. *Australasian Journal of Educational Technology, 28*(1), 159-181. doi:10.14742/ajet.889

Liang, G., Song, J., Li, G., Wang, Z., Yin, H., Liu, G., & Walls, R. (2007). Comparative study on technology preparation in teacher education: The U.S. and China. *International Journal* *of Instructional Media, 34*, 265-274. Retrieved from https://www.learntechlib.org/j/ISSN-0092-1815/

Liang, W., Hou, L., & Chen, W. (2008). Left-behind children in rural primary schools: The case of Sichuan province. *Chinese Education and Society, 41*(5), 84-99. doi:10.2753/ced1061-1932410506

Linnan, L. & Steckler, A. (2002). *Process evaluations for public health interventions and research.* San Francisco, CA, John Wiley and Sons.

Linnenbrink, E., & Pintrich, P. R. (2003). The role of self-efficacy beliefs in student engagement and learning in the classroom. *Reading & Writing Quarterly*, *19*, 119-137. doi:10.1080/10573560390143076

Liu, Q., Zhang, S., & Wang, Q. (2015). Surveying Chinese inservice K12 teachers' technology, pedagogy, and content knowledge. *Journal of Educational Computing Research*, *53*(1), 55-74. doi:10.1177/0735633115585929

Liu, S., & Feng, D. (2015). How culture matters in educational borrowing? Chinese teachers' dilemmas in a global era. *Cogent Education*, *2*(1), 1-15. doi:10.1080/2331186X.2015.1046410

Lock, J. V. (2006). A new image: Online communities to facilitate teacher professional development. *Journal of Technology and Teacher Education*, *14*, 663-678. Retrieved from www.aace.org/pubs/jtate/

Long, T., Liang, W., & Yu, S. (2013). A study of the tablet computer's application in K-12 schools in China. *International Journal of Education and Development using Information and Communication Technology*, *9*(3), 61-70. Retrieved from http:// ijedict.dec.uwi.edu/

Loucks-Horsley, S., Styles, K. & Hewson, P. (1996). Principles of effective professional development for mathematics and science education: A synthesis of standards. *National Institute for Science Education Brief, 1*(1), 1-6. Retrieved from http://archive.wceruw.org/nise/

Lowyck, J., & Elen, J. (2004). Linking ICT, knowledge domains, and learning support for the design of learning environments. In N. M. Seel & S. Dijkstra (Eds.), *Curriculum, plans, and processes in instructional design* (pp. 239-256). Mahwah, NJ: Erlbaum. doi:10.4324/9781410610560

MacDonald, R. (2008). Professional development for information communication technology integration: Identifying and supporting a community of practice through design-based research. *Journal of Research on Technology in Education, 40*, 429-445. doi:10.1080/15391523.2008.10782515

Machado, L. J., & Chung, C. (2015). Integrating technology: The principals' role and effect. *International Education Studies, 8*(5), 43-53. doi:10.5539/ies.v8n5p43

Martin, W., Strother, S., Beglau, M., Bates, L., Reitzes, T., & McMillan Culp, K. (2010). Connecting instructional technology professional development to teacher and student outcomes*. Journal of Research on Technology in Education, 43*(1), 53–74. doi:10.1080/15391523.2010.10782561

Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Matzat, U. (2013). Do blended virtual learning communities enhance teachers' professional development more than purely virtual ones? A large scale empirical comparison. *Computers & Education, 60*(1), 40-51. doi:10.1016/j.compedu.2012.08.006

Mingyuan, G. (2006). An analysis of the impact of traditional Chinese culture on Chinese Education. *Frontiers of Education in China, 2*, 169-190. doi:10.1007/s11516-006-0001-8

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*, 1017–1054. doi:10.1111/j.1467-9620.2006.00684.x

Morrison, J. (2017a). *Session 1: Defining and understanding a mixed methods approach to inquiry and design*. Retrieved from https://blackboard.jhu.edu/bbcswebdav/pid-4468840-dt-content-rid-19040733_2/courses/ED.883.719.1B.FA17/RMII%20Session%201%20presentationOriginalFinalPresenter_1_.pdf

Morrison, J. (2017b). *Session 2: Exploring mixed methods designs*. Retrieved from https://blackboard.jhu.edu/bbcswebdav/pid-4468847-dt-content-rid-19040773_2/courses/ED.883.719.1B.FA17/RMII%20Session2Final%281%29.pdf

Mueller, J., Wood, E., Willoughby, T., Ross, C., & Specht, J. (2008). Identifying discriminating variables between teachers who fully integrate computers and teachers with limited integration. *Computers and Education, 51*, 1523–1537. doi:10.1016/j.compedu.2008.02.003

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytic investigation. *Journal of Counseling Psychology, 38*(1), 30-38. doi:10.1037/0022-0167.38.1.30

Neal, J. W., & Neal, Z. P. (2013). Nested or networked? Future directions for ecological systems theory. *Social Development*, 22, 722-737. doi:10.1111/sode.12018

Nespor, J. (1987). The role of beliefs in the practice of teaching. *Journal of Curriculum Studies, 19*, 317–328. doi:10.1080/0022027870190403

Oddone, F. (2016). Self-efficacy: A booster for pedagogical innovation. *Journal of e-Learning and Knowledge Society*, *12*(3), 51-64. doi:10.20368/1971-8829/1155

Onwuegbuzie, A. J., & Leech, N. L. (2006). Linking research questions to mixed methods data analysis procedures. *The Qualitative Report, 11,* 474-498. Retrieved from http://www.nova.edu/ssss/QR/QR11-3/onwuegbuzie.pdf

Overbaugh, R., & Lu, R. (2008). The impact of a NCLB-EETT funded professional development program on teacher self-efficacy and resultant implementation. *Journal of Research on Technology in Education, 41*(1), 43-61. doi:10.1080/15391523.2008.10782522

Owston, R. D., Sinclair, M., & Wideman, H. (2008). Blended learning for professional development: An evaluation of a program for middle school mathematics and science teachers. *Teachers College Record, 110*, 1033-1064. Retrieved from www.tcrecord.org/

Pajares, F. (2002). *Overview of social cognitive theory and of self-efficacy*. Retrieved from http://www.uky.edu/~eushe2/Pajares/eff.html

Pajares, F. (1996). Self-efficacy beliefs in achievement settings. *Review of Educational Research, 66*, 543-578. doi:10.2307/1170653

Pan, S., & Franklin, T. (2011). Inservice teachers' self-efficacy, professional development, and web 2.0 tools for integration. *New Horizons in Education, 59*(3), 28-40. Retrieved from http://www.tojned.net/

Partnership for 21st Century Skills. (2005). *21st century skills, education and competitiveness: A resource and policy guide.* Retrieved from http://www.p21.org/

Pedró, F. (2006). *The new millennium learners: Challenging our views on ICT and learning*. Inter-American Development Bank. Retrieved from https://publications.iadb.org/bitstream/handle/11319/2432/The%20New%20Millennium%20Learners:%20Challenging%20our%20Views%20on%20ICT%20and%20Learning.pdf?sequence=1

Penuel, W.R., Fishman, B.J., Yamaguchi, R., & Gallagher, L.P. (2007). What makes professional development effective? Strategies that foster curriculum implementation. *American Educational Research Journal, 44*, 921-958. doi: 10.3102/0002831207308221

Pintrich, P. R., & Schrauben, B. (1992). Students' motivational beliefs and their cognitive engagement in classroom tasks. In D. Schunk & J. Meece (Eds.), *Student perceptions in the classroom: Causes and consequences* (pp. 1497183). Hillsdale, NJ: Erlbaum.

Pintrich, P. R., & Schunk, D. H. (1996). *Motivation in education: Theory, research and applications.* Englewood Cliffs, NJ: Prentice Hall Merrill.

Prestridge, S., & Tondeur, J. (2015). Exploring elements that support teachers engagement in online professional development. *Education Sciences, 5*, 199-219. doi:10.3390/educsci5030199

Rajaram, K. (2013). Followers of Confucianism or a new generation? Learning culture of mainland Chinese: In pursuit of Western-based business education away from mainland China. *International Journal of Teaching and Learning in Higher Education*, 25, 369-377. Retrieved from http://www.isetl.org/ijtlhe/

Reeves, T. D., & Pedulla, J. J. (2013). Bolstering the impact of online professional development for teachers. *The Journal of Educational Research & Policy Studies, 1*, 50-66. Retrieved from http://www.aera.net/

Rogers, E. M. (2003). *Diffusion of innovations*. New York, NY: Free Press.

Rohaan, E. J., Taconis, R., & Jochems, W. M. G. (2012). Analysing teacher knowledge for technology education in primary schools. *International Journal of Technology and Design Education, 22*, 271–280. doi:10.1007/s10798-010-9147-z

Rossi, P., Lipsey, M., & Freeman, H. (2004). An overview of program evaluation. In P. Rossi, M. Lipsey, & H. Freeman (Eds.), *Evaluation: A systematic approach* (pp. 1-30). Thousand Oaks, CA: Sage.

Russell, M., Bebell, D., O'Dwyer, L., & O'Connor, K. (2003). Examining teacher technology use: Implications for preservice and inservice teacher preparation. *Journal of Teacher Education*, *54*, 297–310. doi:10.1177/0022487103255985

Russell, M., Carey, R., Kleiman, G., & Venable, J. D. (2009). Face-to-face and online professional development for mathematics teachers: A comparative study. *Journal of Asynchronous Learning Networks, 13*(2), 71-87. Retrieved from https://www.learntechlib.org/p/104029/

Sang, G., Valcke, M., van Braak, J. V., Tondeur, J., & Zhu, C. (2011). Predicting ICT integration into classroom teaching in Chinese primary schools: Exploring the complex interplay of teacher-related variables. *Journal of Computer Assisted Learning, 27*, 160-172. doi:10.1111/j.1365-2729.2010.00383.x

Sang, G., Valcke, M., Tondeur, J., Zhu, C., & van Braak, J. V. (2012). Exploring the educational beliefs of primary education student teachers in the Chinese context. *Asia Pacific Education Review, 13*, 417-425. doi:10.1007/s12564-012-9206-0x

Sawyer, R. K. (2005). *The Cambridge Handbook of the Learning Sciences.* New York, NY: Cambridge University Press. doi:10.1017/cbo9780511816833

Schommer, M. (1990). Effects of beliefs about the nature of knowledge on comprehension. *Journal of Educational Psychology, 82*, 498-504. doi:10.1037/0022-0663.82.3.498

Schommer, M. (1994). Synthesizing epistemological belief of research: tentative understandings and provocative confusions. *Educational Psychology Review, 6*, 293-319. doi:10.1007/BF02213418

Schulte, A., Easton, J., & Parker, J. (2009). Advances in treatment integrity research: Multidisciplinary perspectives on the conceptualization, measurement, and enhancement of treatment integrity. *School Psychology Review, 38*, 460–475. Retrieved from http://naspjournals.org

Schunk, D. H. (1989). Self-efficacy and achievement behaviors. *Educational Psychology Review, 1*, 173-208. Doi:10.1007/bf01320134

Schunk, D. H. (1991). Self-efficacy and academic motivation. *Educational Psychologist, 26*, 207-231. doi:10.1207/s15326985ep2603&4_2

Schunk, D. H. (1995). Self-efficacy and education and instruction. *The Plenum Series in Social/Clinical Psychology*, 281–303. doi:10.1007/978-1-4419-6868-5_10

Schunk, D. H., & Pajares, F. (2002). The development of academic self-efficacy. *Development of Achievement Motivation*, 15–31. doi:10.1016/b978-012750053-9/50003-6

Schunk, D. H. (2012). *Learning theories: An educational perspective* (6th ed.). Boston, MA: Pearson.

Shadish, W., Cook, T., & Campbell, D. (2002). *Experimental and quasi-experimental designs for generalized causal inference.* Boston, MA: Houghton Mifflin.

Shaha, S., Glassett, K., Copas, A., & Ellsworth, H. (2015). Title I schools: The student-based impact of online, on-demand professional development on educators. *Contemporary Issues in Education Research, 8*, 227-234. doi:10.19030/cier.v8i4.9430

Shohel, M. M. C., & Banks, F. (2012). School-based teachers' professional development through technology-enhanced learning in Bangladesh. *Teacher Development, 16*(1), 25-42. doi:10.1080/13664530.2012.668103

Shriner, M., Clark, D. A., Nail, M., Schlee, B. M., & Libler, R. (2010). Social studies instruction: Changing teacher confidence in classrooms enhanced by technology. *The Social Studies, 101*, 37-45. doi:10.1080/00377990903283999

Simmel, G. (1955 [1922]). The web of group affiliations. In R. Bendix (Trans.), *Conflict and the web of group affiliations* (pp. 126–195). Glencoe, IL: Free Press.

Smith, S. U., Hayes, S., & Shea, P (2017). A critical review of the use of Wenger's Community of Practice (CoP) theoretical framework in online and blended learning research, 2000-2014, *Online Learning 21*(1), 209-237. doi: 10.24059/olj.v21i1.963

Snow-Gerono, J. L. (2005). Professional development in a culture of inquiry: PDS teachers identify the benefits of professional learning communities. *Teaching and Teacher Education, 21*, 241–256. doi:10.1016/j.tate.2004.06.008

Sparks, D. (2002). *Designing powerful professional development for teachers and principals*. Oxford, OH: National Staff Development Council.

Spires, H. A., Morris, G., & Zhang, J. (2012). New literacies and emerging technologies: Perspectives from U.S. and Chinese middle level teachers. *Research in Middle Level Education, 35*(10), 1-11. doi:10.1080/19404476.2012.11462093

Swan, B., & Dixon, J. (2006). The effects of mentor-supported technology professional development on middle school mathematics teachers' attitudes and practice. *Contemporary Issues in Technology and Teacher Education, 6*(1), 67 -86. Retrieved from www.citejournal.org/

Tan, G. (2010). Under the same blue sky? Inequity in migrant children's education in China. *Current Issues in Comparative Education, 12*(2), 31-40. Retrieved from http://www.tc.columbia.edu/cice/

Tay, L. Y., Lim, C. P., & Lim, S. K. (2015). Differences in ICT usage across subject areas: A case of an elementary school in Singapore. *Journal of Educational Computing Research, 53*(1), 75-94. doi:10.1177/0735633115585930

Teddlie, C., & Tashakkori, A. (2003). Major issues and controversies in the use of mixed methods in the social and behavioral sciences. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social and behavioral research* (pp. 3-50). Thousand Oaks, CA: Sage.

Thakkar, D. (2011). Social & cultural contexts of Chinese learners: Teaching strategies for American educators. *Multicultural Education, 19*, 51-54. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ986897&site=ehost-live&scope=site

Tondeur, J., van Braak, J., & Valcke, M. (2007). Towards a typology of computer use in primary education. *Journal of Computer Assisted Learning, 23*, 197–206. doi:10.1111/j.1365-2729.2006.00205.x

Trilling, B., & Fadel, C. (2009). *21st century skills: Learning for life in our times*. San Francisco, CA: Jossey-Bass.

Tschannen-Moran, M., & Woolfolk Hoy, A. (2001). Teacher efficacy: Capturing and elusive construct. *Teaching and Teacher Education*, *17*, 783-805. doi:10.1016/s0742-051x(01)00036-1

Uslu, O., & Bumen, N. T. (2012). Effect of the professional development program on Turkish teachers: Technology integration along with attitude towards ICT in education. *The Turkish Online Journal of Educational Technology, 11*(3), 115-127. Retrieved from http://www.tojet.net/

van Tryon, P. J. S, & Schwartz, C. S. (2012). A pre-service teacher training model with instructional technology graduate students as peer coaches to elementary pre-service teachers. *TechTrends, 56*(6), 31-36. doi:10.1007/s11528-012-0611-3

Vavasseur, C. B., & Kim MacGregor, S. (2008). Extending content-focused professional development through online communities of practice. *Journal of Research on Technology in Education, 40*, 517-536. doi:10.1080/15391523.2008.10782519

Verloop, N., Van Driel, J., & Meijer, P. (2001). Teacher knowledge and the knowledge base of teaching. *International Journal of Educational Research, 35*, 441–461. doi:10.1016/s0883-0355(02)00003-4

Walker, A., Recker, M., Ye, L., Robertshaw, M. B., Sellers, L., & Leary, H. (2012). Comparing technology-related teacher professional development designs: A multilevel study of teacher and student impacts. *Educational Technology Research & Development, 60*, 421-444. doi:10.1007/s11423-012-9243-8

Wan, G. (2012). The educational development in China: Perspectives from the West. *New Horizons in Education, 60(2),* 1-20. Retrieved from http://www.tojned.net/

Wang, J. (2013). Constant and emerging characteristics of Chinese learners in changing school contexts. *Journal of Curriculum Studies, 45*, 277–293. doi:10.1080/00220272.2012.739801

Wang, L., & Du, X. (2014). Chinese teachers' professional identity and beliefs about the teacher-student relationships in an intercultural context. *Frontiers of Education in China, 9*, 429-455. doi:10.3868/s110-003-014-0033-x

Wang, L., Lai, M., & Lo, L. (2014). Teacher professionalism under the recent reform of performance pay in mainland China. *Prospects, 44*, 429-443. doi:10.1007/s11125-014-9315-0

Watson, G. (2006). Technology professional development: Long-term effects on teacher self-efficacy. *Journal of Technology and Teacher Education, 14*(1), 151-165. Retrieved from https://www.aace.org/pubs/jtate/

Wenbin, H. (2012). Thirty years of education in China: Between change and no change. *Chinese Education and Society, 45*(1), 84-94. doi:10.2753/CED1061-1932450110

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity.* New York, NY: Cambridge University Press.

Wenger, E., McDermott, R. A., & Snyder, W. (2002). *Cultivating communities of practice: A guide to managing knowledge.* Boston, MA: Harvard Business Press.

Wenger, E., Tayner, B. & de Laat, M. (2011). *Promoting and assessing value creation in communities and networks: A conceptual framework.* Amsterdam: Ruud de Moor Centrum.

Wenger, E. C., & Snyder, W. M. (2000). Communities of practice: The organizational frontier. *Harvard Business Review, 78*(1), 139-146. Retrieved from https://hbr.org/

Wells G. (2000). Dialogic inquiry in education. In Lee C., Smagorinsky P. (Eds.) *Vygotskyian perspectives on literacy research* (pp. 51–85). New York: Cambridge University Press.

Wells, J. G. (2007). Key design factors in durable instructional technology professional development. *Journal of Technology and Teacher Education, 15*(1), 101-122. Retrieved from https://www.aace.org/pubs/jtate/

Wiggins, A. (2018). Session 7: *Quasi-experiments*. Johns Hopkins University. Retrieved from https://blackboard.jhu.edu/bbcswebdav/pid-4989874-dt-content-rid-21389832_2/courses/ED.883.721.1D.SP18/EEPP_Session7_3_QuasiExperimentsPresenter.pdf

Williams, L. A., Atkinson, L. C., Cate, J. M., & O'Hair, M. J. (2008). Mutual support between learning community development and technology integration: Impact on school practices and student achievement. *Theory Into Practice, 47,* 294–302. doi:10.1080/00405840802329219

Wilson, S. M. & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. *Review of Research in Education, 24,* 173–209. doi:10.2307/1167270

Woronov, T. E. (2008). Raising quality, fostering “creativity”: Ideologies and practices of education reform in Beijing. *Anthropology & Education Quarterly*, *39*, 401-422. doi:10.1111/j.1548-1492.2008.00030.x

Wu, H., Hsu, Y., & Hwang, F. (2007). Factors affecting teachers’ adoption of technology in classrooms: Does school size matter? *International Journal of Science and Mathematics Education, 6*, 63-85. doi:10.1007/s10763-006-9061-88

Xu, S., & Law, W. (2015). Rural education and urbanization: Experiences and struggles in China since the late 1970s. *Global Education Review, 2*(4), 78-100. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ1080908&site=ehost-live&scope=site

Yan, C., & He, C. (2012). ‘Non-traditional programmes for non-traditional students’: teachers’ perceptions of part-time INSET programmes in China. *Teacher Development, 16*(1), 111-124. doi:10.1080/13664530.2012.674292

Yong, Z. (2011). Reflections on modern China and the progressive power of educational studies. *Frontiers of Education in China, 6*, 167-181. doi:10.1007/s11516-011-0127-1

Yoon, K. S., Duncan, T., Lee, S. W.-Y., Scarloss, B., & Shapley, K. L. (2007). *Reviewing the evidence on how teacher professional development affects student achievement* (Issues and Answers Report, REL 2007 No. 033). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance, Regional Education Laboratory Southwest.

Zhan, S. (2008). Changes to a Chinese pre-service language teacher education program: Analysis, results and implications. *Asia-Pacific Journal of Teacher Education, 36*(1), 53-70. doi:10.1080/13598660701793392

Zhang, J. (2007). A cultural look at information and communication technologies in Eastern education. *Educational Technology Research & Development, 55*, 301-314. doi:10.1007/s11423-007-9040-y

Zhao, J., & Xu, F. (2010). The state of ICT education in China: A literature review. *Frontiers of Education in China, 5(*1), 50-73. doi:10.1007/s11516-010-0006-1

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal*, 40, 807-840. doi:10.3102/00028312040004807

Zhao, X., Wang, M., Wu, J., & He, K. (2011). ICT and an exploratory pedagogy for classroom-based Chinese language learning. *The Turkish Online Journal of Educational Technology, 10*, 141-151. Retrieved from http://www.tojet.net/

Zhou, G., Zhang, Z., & Li, Y. (2011). Are secondary preservice teachers well prepared to teach with technology? A case study from China. *Australasian Journal of Educational Technology, 27*, 943-960. doi:10.14742/ajet/922

Appendix A

Needs Assessment Data Analysis Plan

Research Question	Construct(s)	Measurement Tool(s) / Items Location	Analysis Conducted / To Be Conducted
RQ1: What are the teachers' perceptions of the school's current technology-related PD, infrastructure, and school resources for teachers and students? **RQ1a:** How do locally and internationally trained teachers' perceptions of the school's current technology-related PD, infrastructure, and school resources for teachers and students differ?	**Training and Professional Development** Staff development planning and resources established to provide a cogent, effective education environment geared to encourage skill-related development and effective integration of technology within instruction for future teaching needs (An & Reigeluth, 2014; Chang, 2012; Kurt & Ciftci, 2012). **Infrastructure and School Resources** The access provided to technological resources and appropriate technology-use environments within the school and classrooms to teaching staff and students, including school, classroom, and curriculum elements (Chang, 2012; Light, 2010).	**73-item Needs Assessment Teacher Survey** Appendix G – Section IV, Items 1-10 **The 12-item Needs Assessment Teacher Interview Protocol** Appendix E - Teacher Interview Questions: Professional Development and Training, Items 1-5, 12 **The 12-item Needs Assessment Teacher Interview Protocol** Appendix E - Teacher Interview Questions: Self-Efficacy, Item 12 and Open Questions **The 13-item Needs Assessment Principal Interview Protocol** Appendix C - Principal Interview Questions: Vision, Items 7 – 10 Appendix C - Principal Interviews Questions: Technology Plan, Items 11 – 13	**Survey Analysis:** Descriptive statistics including mean, standard error, median, mode, standard deviation, and sample variance were computed for participants' responses. As discussed, some of these variables (median/mode) may not be necessary. Each section was calculated individually on five-point Likert scale except for the demographic portion. I will need to find the Alpha value of combinations of items noted for each tool. **Interview Analysis:** See above for interview analysis procedure.
RQ2: What are teachers' beliefs (epistemological, pedagogical, and self-efficacy) regarding the integration of technology into instructional practices to improve technology-enhanced, student-centered learning experiences to support the development of 21st century skillsets? **RQ2a**: How do locally and internationally trained teachers' beliefs regarding the integration of technology differ?	**Teachers' Epistemological Beliefs** Teachers' beliefs about the nature of knowledge and learning cultivation and creation, including structure, source, stability, speed of learning, and ability to learn (Deng, Chai, Tsai, & Lee, 2014; Kim, Kim, Lee, Spector, & DeMeester, 2013; Schommer, 1990; Schommer, 1998; Schommer-Aikins, Duell, & Hutter, 2005) **Teachers' Pedagogical Beliefs** Teachers' pedagogical beliefs are the systematic strategies and practices educators believe to be productive and efficient for teaching and learning (Deng, Chai, Tsai, & Lee, 2014; Kim, Kim, Lee, Spector, & DeMeester, 2013; Li, Rao, & Tse, 2012; Sang, Valchke, Braak, Tondeur, & Zhu, 2011). **Teachers' Self-efficacy**	**73-item Needs Assessment Teacher** Appendix G – Section II, Items 11 - 26 *Questions referenced from: (Lee, Zhang, Song, & Huang, 2013)* **73-item Needs Assessment Teacher Survey** Appendix G – Section III, Items 27 – 52 *Questions referenced from: (Lee, Zhang, Song, & Huang, 2013)* **73-item Needs Assessment Teacher Survey**	**Survey Analysis:** See above for survey analysis procedure. **Interview Analysis:** See above for interview analysis procedure.

	Teachers' beliefs in their own ability, adequacy, and confidence to affect student performance through classroom instruction to improve student construction of knowledge (Berman, McLaughlin, Bass, Pauly, & Zellman, 1997; Cheung, 2008; Pan & Franklin, 2011).	Appendix G – Section IV, Items 53 – 73 *Questions referenced from: (Cheung, 2008; Zhou, Zhang, & Li, 2011)* **The 12-item Needs Assessment Teacher Interview Protocol** Appendix E - Teacher Interview Questions: Self-Efficacy, Items 11-12	
RQ3: What are teachers' present self-reported instructional practices?	**Present Instructional Practices** The pedagogical daily instructional strategies, activities, and approaches facilitated by educators in the classroom environment to foster and encourage student learning (Lee, Zhang, Song, & Huang, 2013; Li, Rao, & Tse, 2012).	**The 12-item Needs Assessment Teacher Interview Protocol** Appendix E - Teacher Interview Questions: Instructional Practices, Items 6-10	**Interview Analysis:** See above for interview analysis procedure.
RQ4: What are the principal's perceptions of her ability to support teachers to integrate technology, her technology integration vision, and her school planning regarding technology integration to promote students' development of 21st century skillsets?	**Principal Leadership** The principal's technology leadership regarding the creation of a supportive learning community establishing and fostering his/her vision for technology integration in the school context as well as the current technology integration environment within the school connected to current direction and trends of education technology development (Chang, 2012; Li, 2006; Light, 2010; Machado & Chung, 2015). The technology leadership regarding active planning for the context of practice for technology implementation within the school and curriculum, including resource allocation and teacher guidance (Chang, 2012; Light, 2010; Machado & Chung, 2015).	**The 13-item Needs Assessment Principal Interview Protocol** Appendix C - Principal Interview Questions: Vision, Items 1 – 10 Appendix C - Principal Interview Questions: Technology Plan, Items 11 - 13	**Interview Analysis:** The researcher utilized a thematic analysis to examine qualitative interview data from the six participating teachers and principal. This system evaluation involved a hybrid approach of inductive and deductive coding to note the following themes tied to the constructs of this study: (a) principal leadership, (b) professional development, (c) infrastructure and resources, (d) present instructional practices, (e) teacher epistemological beliefs, (f) teacher pedagogical beliefs, (g) teacher self-efficacy (Fereday & Muir-Cochrane, 2006). First, the researcher developed a code system based on themes initially provided in multiple reviews of the semi-structured interviews focused on answering RQ1, RQ2, RQ3, and RQ4. This system was then utilized immediately after the interview transcriptions were completed to provide overall analysis and test reliability (Fereday & Muir-Cochrane, 2006). This review solidified the categories of codes based on reemerging topics, identifying the initial major themes and allowing for a thorough examination. The researcher then coded each of the interview transcripts with attention to newly appearing themes not previously identified. The analysis required constant comparison to combine similar concepts into overarching ones. Finally, codes were corroborated and legitimated with the whole process repeated for a comprehensive review.

Appendix B

Characteristics of Teacher Participants (*n* = 16)

Characteristic	All Teachers *n* (%)	Chinese Teachers *n* (%)	International Teachers *n* (%)
Gender			
Female	14 (87.50)	10 (62.50)	4 (25.00)
Male	2 (12.50)	0 (0.00)	2 (12.50)
Age			
20 – 29	8 (50.00)	4 (25.00)	4 (25.00)
30 – 39	7 (43.75)	5 (31.25)	2 (12.50)
40 – 49	1 (6.25)	1 (6.25)	0 (0.00)
Race			
Caucasian	5 (31.25)	0 (0.00)	5 (31.25)
Black	1 (6.25)	0 (0.00)	1 (6.25)
Asian	10 (62.50)	10 (62.50)	0 (0.00)
Years of Teaching Experience			
0 – 5 years	8 (50.00)	5 (31.25)	3 (18.75)
6 – 10 years	5 (31.25)	2 (12.50)	3 (18.75)
11 – 15 years	3 (18.75)	3 (18.75)	0 (0.00)
Years of Technology Experience			
0 – 5 years	10 (62.50)	7 (43.75)	3 (18.75)
6 – 10 years	4 (25.00)	1 (6.25)	3 (18.75)
11 – 15 years	2 (12.50)	2 (12.50)	0 (0.00)

Grade Level			
Kindergarten	2 (12.50)	1 (6.25)	1 (6.25)
Grade 1	2 (12.50)	1 (6.25)	1 (6.25)
Grade 2	3 (18.75)	2 (12.50)	1 (6.25)
Grade 3	4 (25.00)	2 (12.50)	2 (12.50)
Grade 4	1 (6.25)	1 (6.25)	0 (0.00)
Grade 5	1 (6.25)	0 (0.00)	1 (6.25)
Grade 6	0 (0.00)	0 (0.00)	0 (0.00)
Multiple	3 (18.75)	3 (18.75)	0 (0.00)
Subject(s)			
IPC / All	6 (37.50)	0 (0.00)	6 (37.50)
Chinese and Mathematics	5 (31.25)	5 (31.25)	0 (0.00)
Chinese	2 (12.50)	2 (12.50)	0 (0.00)
Music	1 (6.25)	1 (6.25)	0 (0.00)
Multiple	2 (12.50)	2 (12.50)	0 (0.00)

Appendix C

Teacher Interview Protocol

Please answer the following questions as honestly as possible. Thank you for your time.
请尽可能地如实回答以下问题。谢谢您的参与。

Participant Code 参与编号:	**Project Name 项目名称:**	**Project Number 项目编号:**
____________________	Needs Assessment Study 需求测评研究	N/A
Researcher:	**Date:**	
Bill Boland	[Date]	

Perceptions of Professional Development

1) 职业发展认知Can you describe your preservice training experience regarding technology integration into instruction?
能否请您描述一下就将科技融入教学的岗前培训经历？

2) Can you describe your training experience while working as a teacher regarding technology integration into instructional practices? What about specifically for the Beijing Primary School?
能否请您描述一下在担任教师期间，将科技融入教学实践的培训经历？在常春藤国际学校的这段时间呢？

3) What are your current needs regarding professional development connected to technology implementation?
您目前有哪些跟科技运用相关的职业发展需求？

4) Do you feel the current professional development within your school adequately meets your needs regarding using technology within your instruction? Why or why?
您觉得校园内的职业发展是否满足您将科技运用到教学的需求？为什么是或不适？

5) Please describe your ideal professional development approach regarding technology integration.
请您描述将科技融入教学的理想的职业发展方法。

Instructional Practices
教师访谈问题：教学实践

6) How do you feel students learn most effectively?
您觉得学生怎样学习才最高效？

7) How do you view the importance of technology integration for student achievement and construction of knowledge? What about for learning 21st century skills?
您如何看待将科技融入教学实践在促进学生的成绩和知识构建方面的重要性？对21世纪技能的掌握呢？

8) Can you describe your preparation procedure for a lesson in which you integrated technology? What concerned you the most when you were planning the lesson?
能否麻烦您描述一下您将科技融入课堂教学时的备课步骤？您在备课的时候最关心的是什么？

9) What technologies do you believe are most effective to improve student knowledge in instructional practices? Why?
您认为哪种科技在教学实践中最能在知识方面帮助提高学生？为什么？

10) Have you felt the need to alter your instructional practices to integrate technology?
您是否曾觉得需要调整教学实践，以将科技融合进来？

Self-Efficacy
教师访谈问题：自我效能

11) Do you feel comfortable with implementing technology-based instruction within your classroom? Why or why not?
您在课堂运用基于科技的教学会让您感到舒适吗？为什么会或不会？

12) Do you feel the school support you have received has improved your confidence using technology within instructional practices? Why or why not?
从校方获得的支持有没有让您觉得提高了您在教学实践中运用科技的信心？为什么有或没有？

Appendix D

Teacher Survey

Please complete the following survey based on your opinions and the instructions contained in each section. It is important to answer questions as honestly as possible. The survey should take approximately 15 to 20 minutes. Thank you for your time.
请您按照每部分的说明，基于您自身的观点完成问卷。请尽量如实回答所有问题。完成问卷大概需要15-20分钟。

Participant Code 参与编号:	**Project Name 项目名称:**	**Project Number 项目编号:**
____________________	Needs Assessment Study 需求测评调研	N/A
Researcher 研究者:	**Date 日期:**	
Bill Boland	[Date]	

Section I: Perceptions of Professional Development
第四部分：职业发展

This section of the survey will focus on current training and professional development programs within your school context and your perceived effectiveness of them. Please indicate your agreement with each of the following statements by marking the appropriate box. Make certain you indicate ONLY one response for each item.
该部分将着重调研您的学校所提供的职业发展项目及效果。就以下表述，请选择最契合您的同意程度的一项。单选。

		Strongly Disagree 完全不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
1.	They help me improve my technology knowledge. 这些职业发展项目能帮助我提高我的科技知识。					

2.	They help me understand how teaching and learning change when particular technologies are used. 这些职业发展项目能帮助我理解将特定科技运用到教学活动时，教与学会如何变化。					
3.	They help me improve my pedagogical knowledge. 这些职业发展项目能帮助我提高教学法知识。					
4.	They help me create a technology-enhanced, learner-centered classroom. 这些职业发展项目能帮助我利用科技强化课堂，实现在教学中以学生为中心。					
5.	They help me improve my content knowledge about the subject matter I teach. 这些职业发展项目能帮助我增加了所教科目的知识。					
6.	They help me create a learner-centered classroom. 这些职业发展项目能帮助我创造了一个以学生为中心的课堂。					
7.	The current professional development programs and activities meet my satisfaction. 目前的职业发展项目和活动能让我满意。					
8.	They provide subject-specific technology integration ideas. 这些职业发展项目能提供将科技融入到具体学科的办法。					
9.	They focus primarily on how to merely operate the technology. 这些职业发展项目只着重于如何操作科技设备。					
10.	They provide some technology integration ideas but they are too general to be applied easily to my classroom.					

	这些职业发展项目能帮助能提供一些融入科技的办法，但是太泛，不能便捷地运用到我的课堂。					

Section II: Epistemological Beliefs
第二部分：认识论信念

Please indicate your agreement with each of the following statements by marking the appropriate box. Make certain you indicate ONLY one response for each item.
就以下表述，请选择最契合您的同意程度的一项。单选。

		Strongly Disagree 完全不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
11.	Our abilities to learn are fixed at birth. 我们的学习能力在出生时就决定了。					
12.	One's innate ability limits what one can do. 一个人的天赋限制了这个人能做什么。					
13.	Some people are born good learners, others are limited in their learning capacity. 有些人天生就是擅长学习的人，有些人的学习能力是有限的。					
14.	The ability to learn is innate/inborn. 学习的能力是先天的/天生的。					
15.	Students who begin school with "average" ability remain "average" throughout school. 开始上学时能力表现"一般般"的学生，在整个上学过程中都会停留在"一般般"。					
16.	The really smart students do not have to work hard to do well in school. 真正聪明的学生不需要特别努力才能取得好成绩。					
17.	How much you get from your learning depends mostly on your effort. 学习成绩主要取决于努力的程度。					

18.	Getting ahead takes a lot of work. 名列前茅需要付出很多努力。					
19.	If one tries hard enough, then one will understand what is being taught in class. 只要学生足够努力就能理解课上所教的内容。					
20.	Sometimes I do not believe the facts in textbooks written by authorities. 有时候，我不相信由权威人士写的科书上的内容。					
21.	Even advice from experts should often be questioned. 即使是专家的建议，也值得经常被质疑。					
22.	I often wonder how much experts really know. 我常想专家们多底知道多少东西。					
23.	If scientists try hard enough, they can find the truth to almost anything. 科学家们只要足够努力，就能发现任何事物的真理。					
24.	Anyone can figure out difficult concepts if one works hard enough. 任何人只要足够努力，就能理解复杂的概念。					
25.	I believe there should exist a teaching method applicable to all learning situations. 我相信有能适用于所有学习情境的教学方法。					
26.	Scientific knowledge is certain and does not change. 科学知识是确定的，不会变化。					

Section III: Pedagogical Beliefs

第一部分：教学信念

Please indicate your agreement with each of the following statements by marking the appropriate box. Make certain you indicate ONLY one response for each item.

就以下表述，请选择最契合您的同意程度的一项。单选。

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
27.	It is important that a teacher understands the feelings of the students. 老师理解学生的感受是非常重要的。					
28.	Good teachers always encourage students to think for answers themselves. 好的老师总是会鼓励学生自己思考答案。					
29.	Learning mainly involves absorbing as much information as possible. 学习主要是要尽可能多的吸收信息。					
30.	Students have to be called on all the time to keep them under control. 课堂上总是要点名字才能管好学生。					
31.	Learning means students have ample opportunities to explore, discuss and express their ideas. 学习意味着学生有充足的机会去探索、讨论和表达自己的想法。					
32.	In classrooms, there should be a democratic and free atmosphere that stimulates students to think and interact. 在课堂上要有能激发学生思考和互动的民主和自由氛围。					
33.	Every child is unique or special and deserves an education tailored to his or her particular needs. 每个学生都是独特唯一的，值得享受能根据他或她的特定需求而定制的教育。					
34.	The major role of a teacher is to transmit knowledge to students. 教师的主要角色是将知识传授给学生。					
35.	Learning occurs primarily from drilling and practice. 学习的目标主要通过演练和练习来实现。					

36.	Effective teaching encourages more discussion and hands on activities for students. 有效的教学更能鼓励学生讨论和参与需要动手活动。					
37.	The focus of teaching is to help students construct knowledge from their learning experience instead of knowledge communication. 教学应聚焦在帮助学生从学习经验中构建知识而不是将知识传输给学生。					
38.	Instruction should be flexible enough to accommodate individual differences among students. 教学活动必须灵活，以适应学生的不同特点。					
39.	I have really learned something when I can remember it later. 如果事后还能记住，那我就真的学到了东西。					
40.	Teaching is simply telling, presenting or explaining the subject matter. 教学只是简单地讲述、呈现或解释教学主题。					
41.	Different objectives and expectations in learning should be applied to different students. 应该为不同的学生设置不同的教学目标和期望值。					
42.	Students should be given many opportunities to express their ideas. 应该多给学生机会去表达他们自己的想法。					
43.	Teachers should have control over what students do all the time. 老师应该总是管着学生在做什么。					
44.	The ideas of students are important and should be carefully considered. 学生的想法非常重要，应该被认真考虑。					
45.	Good teachers always make their students feel important. 好老师总是能让学生自己知道自己很重要。					

46.	The traditional lecture method for teaching is best because it covers more information. 传统的授课方式最好，因为它涵盖更多的信息。					
47.	It is best if teachers exercise as much authority as possible in the classroom. 老师在课堂越有威信越好。					
48.	Good teaching occurs when the teacher leads the discussion and the students listen with little interaction. 老师主导讨论，学生倾听，互动不多时能产生好的教学效果。					
49.	The only purpose of teaching is to provide students with accurate and complete knowledge rather than encourage them to discover it. 教学的唯一目标是为学生提供准确和完整的信息，而不是鼓励他们去发现。					
50.	A teacher's task is to correct learning misconceptions of students right away instead of allowing the students to verify them for themselves. 老师的任务是马上纠正学生的错误，而不是允许学生自己去求证。					
51.	No learning can take place unless students are controlled. 如果学生不被管着，就不会学习。					
52.	Learning to teach simply means practicing the ideas from lecturers. 学习教学就是指学习讲课。					

Section IV: Self-Efficacy
第三部分：自我效能

Please indicate your agreement with each of the following statements by marking the appropriate box. Make certain you indicate ONLY one response for each item.
就以下表述，请选择最符合您实际情况的一项 。单选。

		None At All 根本没有	Very Little 很少	Some Degree 有一些	Quite A Bit 相当多	A Great Deal 很多

53.	How much can you utilize technology within your instruction in the classroom? 您在教学实践中运用科技吗？					
54,	How much can you use technology in general? 总的来说，您在教学中运用科技吗？					
55.	How much can you use technology to help your students think critically? 科技的运用在帮助您的学生进行辩证思考方面有作用吗？					
56.	How much can you utilize technology to motivate students who show low interest in school work? 科技的运用对学习不感兴趣的学生有激励作用吗？					
57.	How much can you make expectations clear to students regarding technology activities? 在运用科技的教学活动中，您能让学生清晰地明白上课应该达到什么效果吗？					
58.	How well can you establish routines to keep activities involving technology running smoothly? 为确保运用科技的课堂活动能顺利进行，您会建立相应的课堂常规秩序吗？					
59.	How much can you help students utilize technology to improve their learning and school work? 科技的运用能帮助学生提高他们的学习和学业成绩吗？					
60.	How much can you help students value learning through instruction with technology? 在教学实践中运用科技能帮助学生们重视学习吗？					
61.	How much can you gauge student comprehension of what you have taught in activities involving technology?					

	在运用了科技的课堂活动中，学生对所学内容的理解程度如何？					
62.	How much can you do to foster student creativity using technology? 科技的运用能帮助您提高学生的创造力吗？					
63.	How much can you establish technology within individual and group student work?您会在学生单独和小组的学习活动中运用科技吗？					
64.	How much can you use a variety of technology integration strategies within your instruction? 在您的课堂教学中，您会采取一些运用科技的策略吗？					
65.	How much can you establish a variety of assessment strategies with activities involving technology? 在运用了科技的教学活动中，您会采取各种测评策略吗？					
66.	How much can you do to improve the understanding of students regarding a particular subject using technology? 科技的运用能帮助学习提高对特定科目的知识的理解吗？					
67.	To what extent can you use technology to provide an alternative explanation or example when students are confused? 学生困惑不解时，您能否借助科技为他们进行解说和举例子？					
68.	How well can you manage student behavior during activities with technology? 在运用了科技的课堂活动中，您能管理学生的行为吗？					
69.	How well can you utilize technology within activities to provide appropriate challenges for very capable students? 在教学活动中运用科技能为能力较强的学生提供适宜的挑战吗？					

70.	How well can you utilize technology to implement alternative learning strategies in your classroom? 您能借助科技在教学实践中运用不同的教学策略吗？					
71.	How much can you do to help students value learning through the use of technology? 科技的运用能帮助您让学生重视学习吗？					
72.	How much can you do to get students to believe that they can do well in school work using technology? 学生们认为科技的运用能帮助他们做好功课吗？					

73. List the three major factors that contribute to your confidence with technology use within instructional practices.

请列出影响您对在教学实践中运用科技的信心的三大主要因素。

a. ____

____

b. ____

____

c. ____

____

Section V: Final Demographic Questions

第五部分：基本信息统计问题

74. Gender 性别: ___________________________

75. Age 年龄: ___________________________

76. Years of Teaching Experience 教学经验年数: ___________________________

77. Years of Classroom Technology Use 在课堂运用科技的年数: _________________________

78. Grade Level 年级: ___________________________

79. Subject 科目: ________________________

Thank you very much for your time taking part in this research survey. All answers will remain confidential to the researcher.
谢谢您抽时间参与该项调研。研究者会对您所有的答案进行保密。

Appendix E

Principal Interview Protocol

Please answer the following questions as honestly as possible. Thank you for your time.

Participant Code:	**Project Name:**	**Project Number:**
___________________	Needs Assessment Study	N/A
Researcher:	**Date:**	
Bill Boland	[Date]	

Vision

1) What do you see as the purpose of technology in the classroom?

2) What do you generally view as the most efficient learning contexts?

3) How do you view the importance of technology integration for student achievement and construction of knowledge? What about for learning 21st century skills?

4) How important is it that your teaching staff integrate technology within their instructional practices?

5) How many teachers on your staff effectively integrate technology? And what do you view as effective integration?

6) Please rank the following three items in order of importance with regards to teacher technology integration: willingness to teacher, professional development, and support from the principal? Can you describe your reasons for these rankings?

7) Please identify the top three barriers preventing integration of technology into instruction within the classroom.

8) What are the top three things your teachers need to improve their technology integration within instructional practices and curriculum?

9) In your opinion, would peer coaching/mentoring be valuable to supporting your teaching staff to implement technology within instruction? Why or why not?

10) In your opinion, would a technology integration specialist be valuable to supporting your teaching staff to implement technology within instruction? Why or why not?

Technology Plan

11) Can you describe your current technology plan for your school?

12) What is the teaching staff's biggest concern regarding the current technology plan for the school?

13) Are there any future goals for assisting teachers with their technology integration into their classrooms?

Appendix F

Needs Assessment Consent Protocol

Teacher Participant Code 教师编号:________________

Johns Hopkins University
Homewood Institutional Review Board (HIRB)
约翰霍普金斯大学
霍姆伍德机构评审委员会（HIRB）

Teacher Informed Consent 教师知情同意书

Title:	Examining the barriers to technology integration for educators to improve student construction of knowledge and 21st century competencies – Beijing, China
Principal Investigator:	Dr. Christine Eith; Dr. Stephen Pape; Bill Boland, Graduate Student, School of Education
Date:	March 31, 2017

题目：教育者将科技融入教学实践以提高学生知识架构和培养学生21世纪应具备的素质时所遇到的壁垒 —中国、北京

主要研究者：Dr. Christine Eith; Dr. Stephen Pape; Bill Boland 教育学院 博士研究生

日期：2017年3月31日

The purpose of this research study is to investigate barriers to technology integration into instructional practices for educators to improve student construction of knowledge and provide students necessary 21st century competencies for the Beijing Collegiate Academy context.

I anticipate that approximately 22 teachers and one (1) principal will participate.

研究基于常春藤国际学校校情，考察教育者将科技融入教学实践以提高学生知识架构和培养学生21世纪应具备的素质时所遇到的壁垒。

预计需要22名老师和1位校长参与调研。

PROCEDURES:

There will be several components for this study:

1. All teachers will participate in brief surveys to collect information regarding your epistemological beliefs, pedagogical beliefs, instructional practices, self-efficacy, and views on professional development. These surveys will have a participant code identifying individuals, which is only accessible by the researcher (Bill Boland). Any reported data will be anonymous.
2. Some teachers and the principal will participate in a semi-structured interview led by the researcher and a bilingual assistant, which will be audiotaped and last approximately 30 to 60 minutes.

Title: Examining the barriers to technology integration for educators to improve student construction of knowledge and 21st century competencies – Beijing, China
PI: Bill Boland

3. Some teachers' prior curriculum and lesson plans (where available) will be collected and reviewed.

Time required: You will be asked to participate in this study for a brief period of time. One brief survey will be completed and participation in the interview will be videotaped for review by the researcher. All documents are need to returned ASAP to Bill Boland due to an upcoming Spring Semester Deadline.

步骤：
该项研究包括几个组成部分：

1. 所有老师将参与一个简短的问卷调研，提供您对职业发展的认识信念、教学信念、教学实践、自我效能和观点，用作信息收集。问卷调研设置参与编号以区分参与个体，该编号仅供研究者（Bill Boland）使用。所有报告数据将以匿名形式出现。
2. 一些老师和校长将参加一个半结构化的访谈，由研究者和一名双语助理主导完成。访谈将录音，时长大概为15至20分钟。
3. 一些老师之前的课程设计和教案（如可提供）将被收集并检阅。

时间要求：受邀参与该项研究的时间简短。需要完成一个简短的问卷，访谈部分将被录像，以供研究者进行回顾。因快接近春季学期的研究截止日期，所有文件需尽快交还给Bill Boland。

RISKS/DISCOMFORTS:

There are no anticipated risks or discomforts to teachers. If lesson plans are not available for review, the researcher shall rely on what is accessible only.

BENEFITS:

Potential benefits are an identification of potential technology integration needs within the school context. This could benefit the development of students' 21st century competencies, expanding student-centered instruction and enhancing problem-solving and critical-thinking skills.

风险与不适：
对老师而言，无预期风险或不适。如不能查阅教案，研究者将依据可得的资料进行研究。

益处：
潜在的益处为结合该校实际，为校园确定科技融合的潜在需求。这可能有助于培养学生21世纪应具备的素质，拓展以学生为中心的教学实践，提高学生解决问题和辩证思考的能力。

VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW:

Your participation in this study is entirely voluntary. You choose whether to agree to take part in the study. If you decide not to participate, there are no penalties, and you will not lose any benefits to which you would otherwise be entitled.

You can stop participation in the study at any time, without any penalty or loss of benefits. If you want to withdraw from the study, please contact Bill Boland via phone or email: (+86) 176 0169 5685, wboland1@jhu.edu.

Title: Examining the barriers to technology integration for educators to improve student construction of knowledge and 21st century competencies – Beijing, China PI: Bill Boland

自愿参与和退出权：

本研究属完全自愿参与。您可自行决定是否参与研究。如果您决定不参加，不会涉及任何处罚，也不会损失任何应得的权益。

您可以在任何时间选择停止参与研究，不会有任何处罚或权益损失。如果您想从研究中退出，请通过电话或邮件联系Bill Boland: (+86) 176 0169 5685, wboland1@jhu.edu。

CONFIDENTIALITY:

Any study records that identify you will be kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the Office for Human Research Protections. (All of these people are required to keep your identity and the identify of your students confidential.) Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

All videotapes and measures will be examined by the Principal Investigator and research affiliates only (including those entities described above). No identifiable information will be included in any reports of the research published or provided to school administration. A participant number will be assigned to all surveys.

Surveys will be collected in paper format, which will not include identifiable information other than whether the teacher is from abroad or local.

Video data of the interviews may be transcribed by an outside agent (transcriptionist), who will de-identify all transcripts by deleting all names from the transcript and only a participant number or pseudonym will be included on these transcripts.

All research data including paper surveys and videotapes will be kept in a locked office. Electronic data will be stored on the PI's computer, which is password protected. Any original tapes or electronic files will be erased and paper documents shredded, ten years after collection.

Only group data will be included in publication; no individual achievement data will ever be published.

保密性：

任何能识别您身份的研究记录将严格保密，受法律保护。您参与研究的记录可能将被负责确保研究以适当的方式进行的人员审阅，包括：约翰霍普金斯大学霍姆伍德机构评审委员会（HIRB）成员和政府机关的公务人员如：人力资源保护办公室。（这些审阅人员将被要求对您的身份和学生的身份进行保密。）所有能识别您的研究记录将仅供该项研究的研究人员查看，除非您准许将其给他人查看。

所有的录像资料和测量仅供主要研究人者和研究附属机构（包括以上提到的单位）查看。绝无具有身份识别性的信息出现在将来要发表出来的研究报告或是上交给学校管理层。参与编号将应用于所有问卷调研。

问卷调研以书面形式展开，除了标记参与老师是国外老师还是本地老师外，不包含任何身份识别性的信息。

Title: Examining the barriers to technology integration for educators to improve student construction of knowledge and 21st century competencies – Beijing, China PI: Bill Boland

访谈的视频资料可能由外部代理机构（录音打字员）进行文字脚本记录，该记录员将把文字脚本中的名字删除，仅保留参与者编号或化名，使脚本不具身份识别性。

所有的研究数据包括纸质调研问卷和录像资料将保管在上锁的办公室。电子版的资料将存储在主要研究者的电脑上，受密码保护。数据收集十年后，所有原始影像资料或电子文档将被清除，所有纸质文档将碎纸销毁。

只有小组的数据会包含在发表物中；任何个体获得的数据将不被发表。

COMPENSATION:

You will not receive any payment or other compensation for participating in this study.

补贴：

该研究不会为您提供任何报酬或是补贴。

IF YOU HAVE QUESTIONS OR CONCERNS:

You can ask questions about this research study at any time during the study by contacting Bill Boland via phone or email: (+86) 176 0169 5685, wboland1@jhu.edu. If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (+001) 410 516-6580.

如果您有任何问题或者疑虑：

在研究期间，如您有任何疑问，您可以打电话或是发邮件联系研究者Bill Boland：(+86) 176 0169 5685，wboland1@jhu.edu。如果您对自己参与研究的权利有疑问或觉得自己在研究中所受待遇不公，请通过拨打电话(+001) 410 516-6580联系约翰霍普金斯大学的霍姆伍德机构评审委员会。

Title: Examining the barriers to technology integration for educators to improve student construction of knowledge and 21st century competencies – Beijing, China PI: Bill Boland

SIGNATURES

WHAT YOUR SIGNATURE MEANS:

Your signature below means that you understand the information in this consent form. Your signature also means that you agree to participate in the study.

By signing this consent form, you have not waived any legal rights you otherwise would have as a participant in a research study.

签名

签名的意义：
您的签名意味着您理解该同意书的内容。
您的签名也意味着您同意参与研究。

签署同意书后，您并不会被剥夺作为研究参与者应享有的所有法律权利。

Signature of Participant 参与者签名 **Date日期**

Signature of Person Obtaining Consent 获得同意的一方签名 **Date 日期**
(Investigator or HIRB-Approved Designee)
（调查者或由HIRB批准的其它制定人员）

Appendix G

Section I: Professional Development Full Table

Item	*M* (*SD*)	Strong Agree / Agree *n* (%)	Neutral *n* (%)	Strong Disagree / Disagree *n* (%)
They help me improve my technology…	3.06 (1.34)	7 (43.75)	4 (25.00)	5 (31.25)
They help me understand how teaching…	3.19 (1.38)	9 (56.25)	2 (12.50)	5 (31.25)
They help me improve my pedagogical…	3.25 (1.29)	9 (56.25)	2 (12.50)	5 (31.25)
They help me create a technology-enhanced…	3.19 (1.28)	8 (50.00)	3 (18.75)	5 (31.25)
They help me improve my content…	3.38 (1.31)	8 (50.00)	3 (18.75)	5 (31.25)
They help me create a learner-centered…	3.06 (1.24)	6 (37.50)	5 (31.25)	5 (31.25)
The current professional development…	2.69 (1.25)	4 (25.00)	6 (37.50)	6 (37.50)
They provide subject-specific…	2.81 (1.22)	5 (31.25)	5 (31.25)	6 (37.50)
They focus primarily on how to…	2.69 (0.95)	2 (12.50)	7 (43.75)	7 (43.75)
They provide some technology integration…	3.38 (0.96)	7 (43.75)	6 (37.50)	3 (18.75)

Note. Several participants contributed handwritten notes in this section. No items on this subscale needed to be reverse-coded.

Appendix H

Section II: Epistemological Beliefs Full Table

Item	*M* (*SD*)	Strong Agree / Agree *n* (%)	Neutral *n* (%)	Strong Disagree / Disagree *n* (%)
Our abilities to learn are fixed at birth.	1.94 (0.85)	1 (6.25)	2 (12.50)	13 (81.25)
One's innate ability limits what one can do.	2.00 (0.82)	1 (6.25)	2 (12.50)	13 (81.25)
Some people are born good learners…	2.44 (0.96)	3 (18.75)	3 (18.75)	10 (62.50)
The ability to learn is innate/inborn.	1.94 (0.68)	0 (0.00)	3 (18.75)	13 (81.25)
Students who begin school with…	1.69 (0.60	0 (0.00)	1 (6.25)	15 (93.75)
The really smart students…	1.81 (0.75)	0 (0.00)	3 (18.75)	13 (81.25)
How much you get from your…	3.13 (1.26)	7 (43.75)	4 (25.00)	5 (31.25)
Getting ahead takes a lot of work.	3.88 (0.50)	13 (81.25)	3 (18.75)	0 (0.00)
If one tries hard enough…	2.88 (0.81)	4 (25.00)	6 (37.50)	6 (37.50)
Sometimes I do not believe…	3.44 (0.81)	8 (50.00)	6 (37.50)	2 (12.50)
Even advice from experts…	3.88 (0.62)	12 (75.00)	4 (25.00)	0 (0.00)
I often wonder how much experts…	3.56 (0.73)	9 (56.25)	6 (37.50)	1 (6.25)
If scientists try hard enough…	2.38 (1.02)	3 (18.75)	3 (18.75)	10 (62.50)
Anyone can figure out difficult…	2.38 (0.81)	1 (6.25)	6 (37.50)	9 (56.25)
I believe there should exist…	2.50 (0.89)	2 (12.50)	6 (37.50)	8 (50.00)
Scientific knowledge is certain…	1.75 (0.45)	0 (0.00)	0 (0.00)	16 (100.00)

Note. No items on this subscale needed to be reverse-coded.

Appendix I

Section III: Pedagogical Beliefs Full Table

Item	*M* (*SD*)	Strong Agree (Agree) *n* (%)	Neutral *n* (%)	Strong Disagree (Disagree) *n* (%)
It is important that a teacher...	4.94 (0.25)	16 (100.00)	0 (0.00)	0 (0.00)
Good teachers always encourage…	4.88 (0.34)	16 (100.00)	0 (0.00)	0 (0.00)
Learning mainly involves absorbing… (M = 2.5)	3.50 (1.32)	8 (50.00)	4 (25.00)	4 (25.00)
Students have to be called on… (M = 3.75)	2.25 (0.58)	0 (0.00)	5 (31.25)	11 (68.75)
Learning means students have ample…	4.50 (0.52)	16 (100.00)	0 (0.00)	0 (0.00)
In classrooms, there should be...	4.31 (0.70)	14 (87.50)	2 (12.50)	0 (0.00)
Every child is unique or special…	4.38 (0.62)	15 (93.75)	1 (6.25)	0 (0.00)
The major role of a teacher is… (M = 3.06)	2.94 (0.93)	6 (37.50)	3 (18.75)	7 (43.75)
Learning occurs primarily from drilling... (M = 3.06)	2.94 (1.24)	7 (43.75)	2 (12.50)	7 (43.75)
Effective teaching encourages more…	4.63 (0.62)	15 (93.75)	1 (6.25)	0 (0.00)
The focus of teaching is to help…	4.19 (0.66)	14 (87.50)	2 (12.50)	0 (0.00)
Instruction should be flexible…	4.75 (0.45)	16 (100.00)	0 (0.00)	0 (0.00)
I have really learned something… (M = 2.31)	3.69 (0.79)	8 (50.00)	8 (50.00)	0 (0.00)
Teaching is simply telling… (M = 4.25)	1.75 (0.58)	0 (0.00)	1 (6.25)	15 (93.75)
Different objectives and expectations…	3.88 (0.81)	12 (75.00)	3 (18.75)	1 (6.25)
Students should be given many…	4.38 (0.50)	16 (100.00)	0 (0.00)	0 (0.00)

Teachers should have control over… (*M* = 3.75)	2.25 (0.86)	1 (6.25)	5 (31.25)	10 (62.50)
The ideas of students are important…	4.44 (0.63)	15 (93.75)	1 (6.25)	0 (0.00)
Good teachers always make their…	4.31 (0.79)	15 (93.75)	0 (0.00)	1 (6.25)
The traditional lecture method for… (*M* = 3.69)	2.31 (0.60)	0 (0.00)	6 (37.50)	10 (62.50)
It is best if teachers exercise… (*M* = 3.31)	2.69 (1.14)	5 (31.25)	4 (25.00)	7 (43.75)
Good teaching occurs when the teacher... (*M* = 4.38)	1.63 (0.62)	0 (0.00)	1 (6.25)	15 (93.75)
The only purpose of teaching is… (*M* = 4.63)	1.38 (0.50)	0 (0.00)	0 (0.00)	16 (100.00)
A teacher's task is to correct… (*M* = 4.44)	1.56 (0.51)	0 (0.00)	0 (0.00)	16 (100.00)
No learning can take place… (*M* = 4.00)	2 (0.63)	0 (0.00)	3 (18.75)	13 (81.25)
Learning to teach simply… (*M* = 4.31)	1.69 (0.70)	0 (0.00)	2 (12.50)	14 (87.50)

Note. Reverse-coded means are beneath applicable items in parenthesis.

Appendix J

Section IV: Self-Efficacy Full Table

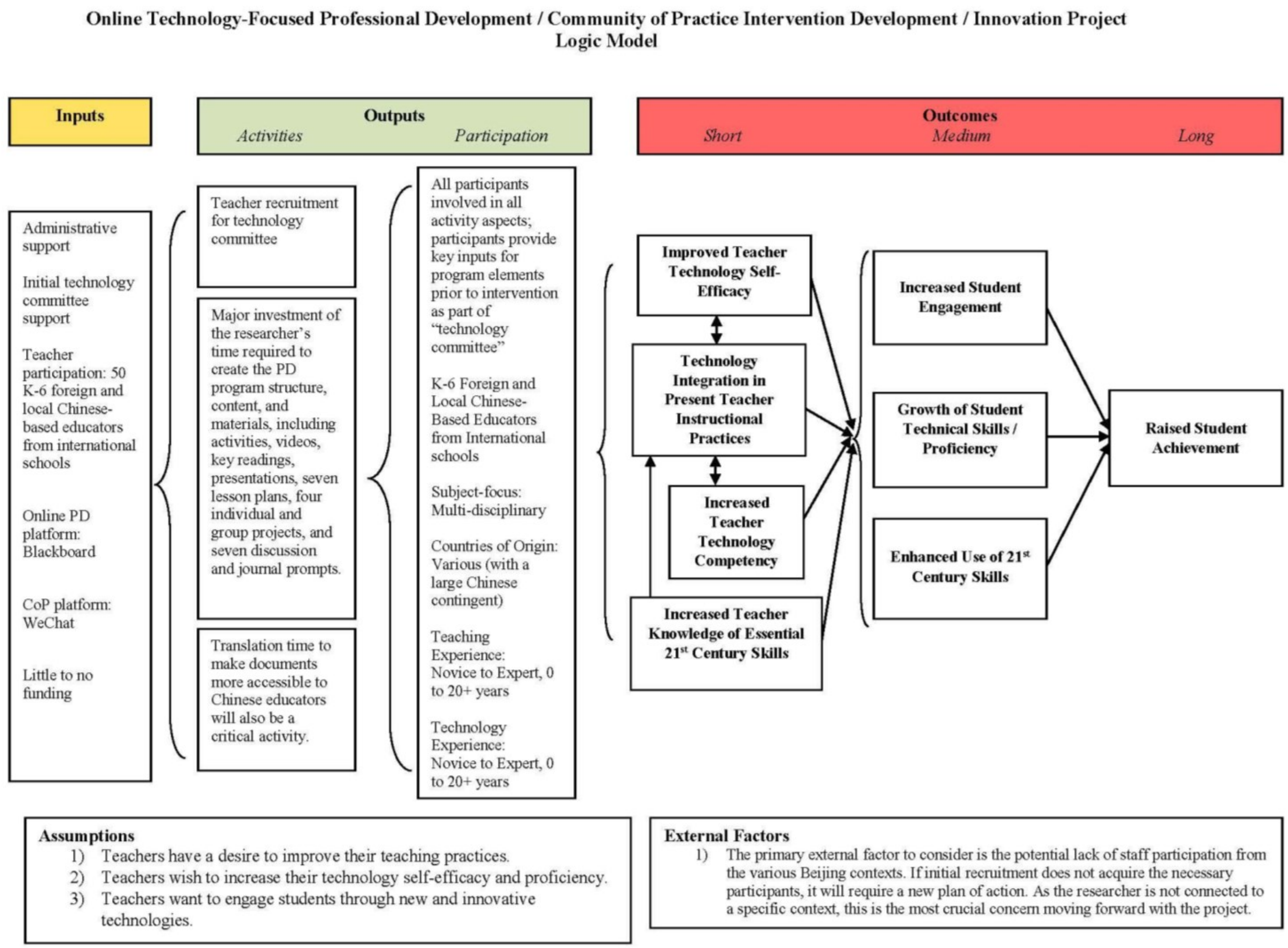
Item	*M* (*SD*)	Strong Agree / Agree *n* (%)	Neutral *n* (%)	Strong Disagree / Disagree *n* (%)
How much can you utilize technology…	3.31 (1.01)	5 (31.25)	8 (50.00)	3 (18.75)
How much can you use technology…	3.75 (1.00)	8 (50.00)	7 (43.75)	1 (6.25)
How much can you use technology to…	3.75 (0.93)	9 (56.25)	6 (37.50)	1 (6.25)
How much can you utilize technology…	3.6 (0.96)	9 (56.25)	5 (31.25)	2 (12.50)
How much can you make expectations…	3.69 (1.01)	9 (56.25)	5 (31.25)	2 (12.50)
How well can you establish routines…	3.63 (1.03)	8 (50.00)	6 (37.50)	2 (12.50)
How much can you help students…	3.06 (0.77)	3 (18.75)	10 (62.50)	3 (18.75)
How much can you help students…	3.06 (0.44)	2 (12.50)	13 (81.25)	1 (6.25)
How much can you gauge student…	3.50 (0.89)	6 (37.50)	9 (56.25)	1 (6.25)
How much can you do to foster…	3.19 (0.65)	3 (18.75)	12 (75.00)	1 (6.25)
How much can you establish…	3.00 (0.82)	3 (18.75)	9 (56.25)	4 (25.00)
How much can you use a variety…	3.19 (0.75)	4 (25.00)	10 (62.50)	2 (12.50)
How much can you establish a variety…	2.81 (0.66)	2 (12.50)	9 (56.25)	5 (31.25)
How much can you do to improve…	3.31 (0.70)	5 (31.25)	10 (62.50)	1 (6.25)
To what extent can you use technology…	3.38 (0.72)	6 (37.50)	9 (56.25)	1 (6.25)
How well can you manage student…	3.75 (0.77)	11 (68.75)	4 (25.00)	1 (6.25)
How well can you utilize technology…	3.31 (0.95)	4 (25.00)	10 (62.50)	2 (12.50)
How well can you utilize technology…	3.31 (0.79)	6 (37.50)	8 (50.00)	2 (12.50)

How much can you do to help students…	3.44 (0.81)	6 (37.50)	9 (56.25)	1 (6.25)
How much can you do to get students…	3.25 (1.00)	5 (31.25)	9 (56.25)	2 (12.50)

Note. *The self-efficacy section contained a final question that was self-response. Note. No items on this subscale needed to be reverse-coded.*

Appendix K

Logic Model



Appendix L

Research Matrix

Construct	Instruments/Measures (Items)	Timing	Data Analysis
Q1: How do participants describe their context relative to support for technology integration to support 21st century learning?			
Context	Context interview protocol assessing contextual types (Appendix P)	October / Once	A priori coding with the potential for emergent codes
Q2: What was the enacted PD and CoP program and to what extent was it implemented with fidelity?			
Program implementation: Dose received	Post-session program survey of participant program awareness, message awareness, and usage of materials (Appendix Q)	January / Seven times (once per session)	Reporting of frequencies, means, and standard deviations
Participant responsiveness: Teacher involvement, participation, enthusiasm, and student interpretation accuracy	Field notes	October – January Seven times (once per session)	A priori coding with the potential for emergent codes
	WeChat CoP screenshot artifacts	October – January	A priori coding with the potential for emergent codes
Initial Use / Process Use	Researcher-Created Beijing Innovation Project Interview Protocol (# 1) (Appendix R)	January / Once	A priori coding with the potential for emergent codes

Q3: What are the participants' experiences within the online PD and CoP program?			
Participant Perceptions of the Intervention	Researcher-Created Beijing Innovation Project Interview Protocol (#'s 2-5) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q3a: What were participants' perceptions of the beneficial or adverse effects of participating in the technology-focused PD and CoP program?			
Participant Perceptions of the Intervention	Researcher-Created Beijing Innovation Project Interview Protocol (# 2-3) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q3b) What components of the technology-focused PD and CoP program do participants perceive as having the greatest value for their development regarding technology self-efficacy, technology competency, technology integration in instructional practices, and knowledge of 21st century skills?			
Participant Perceptions of the Intervention	Researcher-Created Beijing Innovation Project Interview Protocol (# 3) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q3c) What suggestions for improvements do participants have regarding the technology-focused PD and CoP program?			
Participant Perceptions of the Intervention	Researcher-Created Beijing Innovation Project Interview Protocol (# 5) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q3d) What are the relationships between individual characteristics (i.e., technology self-efficacy) and contextual factors (i.e., principal leadership support and resource support) and their experience in the technology-focused PD and CoP program?			

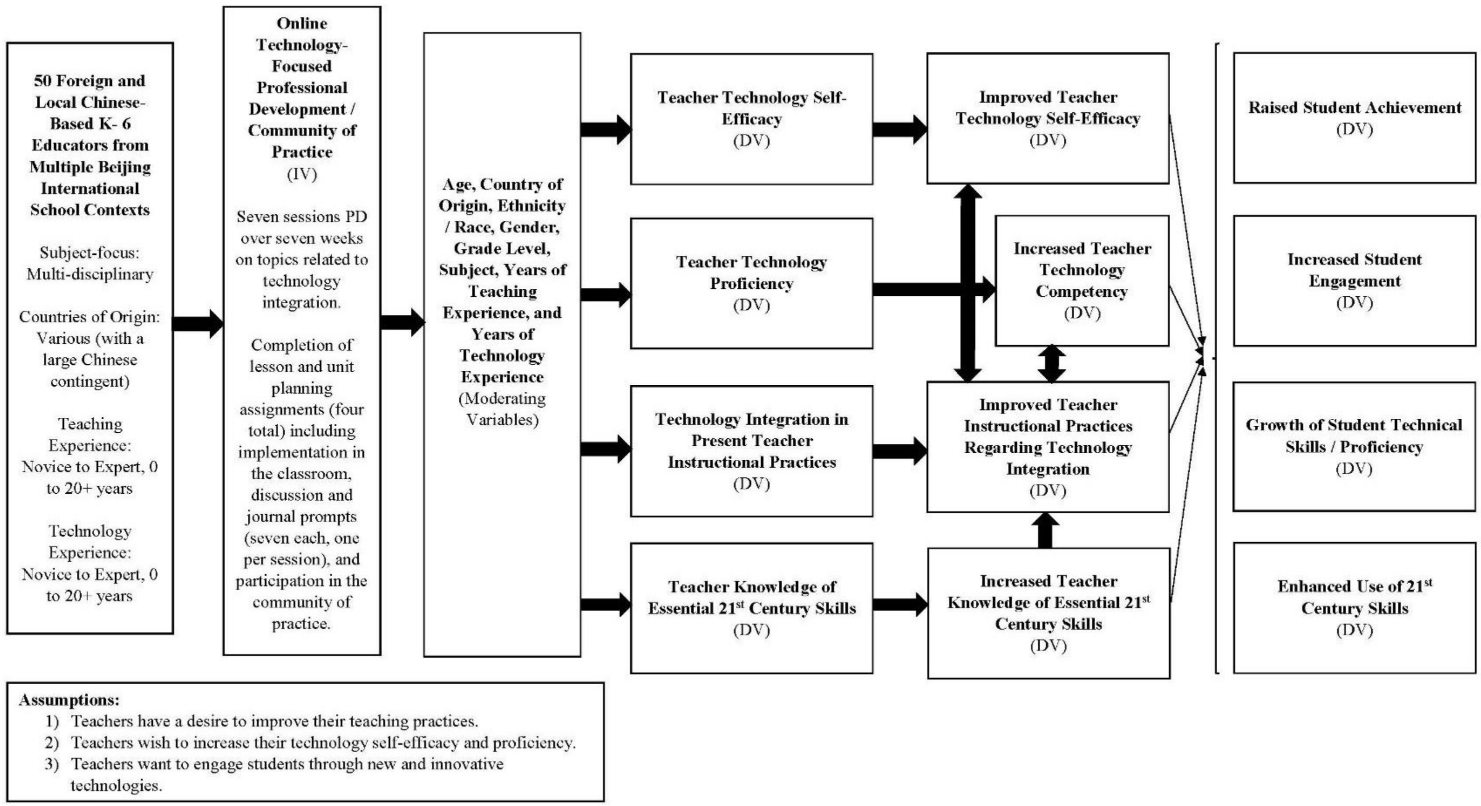
Context	Context interview protocol assessing contextual types (Appendix P)	October / Once	A priori coding with the potential for emergent codes
Technology Self-Efficacy	The Educator Technology Self-Efficacy Survey (ETS-ES) (#'s 1-50) (Appendix S)	October, January	Pre- and Post-Analysis of Inferential Statistics
	Researcher-Created Beijing Innovation Project Interview Protocol (# 6-7) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Participant Perceptions of the Intervention	Researcher-Created Beijing Innovation Project Interview Protocol (#'s 2 – 5) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q4: To what extent do participants report changes in their technology self-efficacy, competency, and instructional practices following the technology-focused PD and CoP program?			
Technology Self-Efficacy	The Educator Technology Self-Efficacy Survey (ETS-ES) (#'s 1-50) (Appendix S)	October, January	Pre- and Post-Analysis of Inferential Statistics
	Researcher-Created Beijing Innovation Project Interview Protocol (# 6-7) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Technology Competency	Researcher-Created Beijing Innovation Project Interview Protocol (# 8-9) (Appendix R)	January / Once	A priori coding with the potential for emergent codes

Technology Integration	Technology Beliefs and Competencies Survey (#'s 1-11) (Appendix T)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 10-12) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q5: How did the participants perceptions change regarding PD following the technology-focused PD and CoP program?			
Perceptions of Professional Development	Professional Development Scale (#'s 1-10) (Appendix U)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 13-14) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q6: What were participants' perceptions of the impact of the technology-focused PD program on their knowledge of important 21st century skills?			
Knowledge of 21st Century Skills	21st Century Skills Teaching Scale (#'s 1-10) (Appendix V)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 15) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Q7: What is the difference in reported technology self-efficacy, technology instructional practices, perceptions of PD, and knowledge of 21st century skills practices between foreign and local participants who were in the technology-focused PD and CoP program?			

Technology Self-Efficacy	The Educator Technology Self-Efficacy Survey (ETS-ES) (#'s 1-50) (Appendix S)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 6-7) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Technology Integration	Technology Beliefs and Competencies Survey (#'s 1-11) (Appendix T)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 10-12) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Perceptions of Professional Development	Professional Development Scale (#'s 1-10) (Appendix U)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 13-14) (Appendix R)	January / Once	A priori coding with the potential for emergent codes
Knowledge of 21st Century Skills	21st Century Skills Teaching Scale (#'s 1-10) (Appendix V)	October, January	Pre- and Post-Analysis of Descriptive Data
	Researcher-Created Beijing Innovation Project Interview Protocol (# 15) (Appendix R)	January / Once	A priori coding with the potential for emergent codes

Appendix M

Theory of Treatment



Appendix N

Characteristics of Intervention Teacher Participants (*n* = 37)

Characteristic	All Teachers *n* (%)	Chinese Teachers *n* (%)	International Teachers *n* (%)
Gender			
Female	28 (75.68)	18 (48.65)	10 (27.00)
Male	9 (24.32)	2 (5.41)	7 (18.92)
Age			
20 – 29	15 (40.54)	9 (24.32)	6 (16.22)
30 – 39	14 (37.84)	10 (27.03)	4 (10.81)
40 – 49	5 (13.51)	0 (0.00)	5 (13.51)
50 – 59	3 (8.11)	1 (2.70)	2 (5.41)
Ethnicity			
Caucasian	11 (29.73)	0 (0.00)	11 (29.73)
Black	2 (5.41)	0 (0.00)	2 (5.41)
Asian	20 (54.05)	20 (54.05)	0 (0.00)
Hispanic	1 (2.70)	0 (0.00)	1 (2.70)
Mixed	3 (8.11)	0 (0.00)	3 (8.11)
Years of Teaching Experience			
0 – 9 years	27 (72.97)	17 (45.95)	10 (27.03)
10 – 19 years	7 (18.92)	2 (5.41)	5 (13.51)
20 – 29 years	2 (5.41)	0 (0.00)	2 (5.41)
30 – 39 years	1 (2.70)	1 (2.70)	0 (0.00)

Years of Technology Experience			
0 – 5 years	23 (62.16)	13 (35.14)	10 (27.03)
6 – 10 years	10 (27.03)	6 (16.22)	4 (10.81)
11 – 15 years	2 (5.41)	0 (0.00)	2 (5.41)
16 – 20 years	2 (5.41)	1 (2.70)	1 (2.70)
Grade Level			
Kindergarten	17 (45.95)	8 (21.62)	9 (24.32)
Grade 1	4 (10.81)	2 (5.41)	2 (5.41)
Grade 2	3 (8.11)	2 (5.41)	1 (2.70)
Grade 3	2 (5.41)	1 (2.70)	1 (2.70)
Grade 4	0 (0.00)	0 (0.00)	0 (0.00)
Grade 5	3 (8.11)	1 (2.70)	2 (5.41)
Grade 6	8 (21.62)	6 (16.22)	2 (5.41)
Subject(s)			
English	16 (43.24)	9 (24.32)	7 (18.92)
Science	3 (8.11)	1 (2.70)	2 (5.41)
Math	1 (2.70)	1 (2.70)	0 (0.00)
Arts	3 (8.11)	3 (8.11)	0 (0.00)
Chinese	1 (2.70)	1 (2.70)	0 (0.00)
Computer	1 (2.70)	1 (2.70)	0 (0.00)
Multiple	12 (32.43)	4 (10.81)	8 (21.62)

Appendix O

Demographic Survey

人口调查

Participant Code:	Project Name:	School Code:
参与者编号:	**项目名称:**	**学校编号:**
___________________	Beijing Innovation Project	___________________
	北京创新项目	
Researcher:	**Date:**	
研究者:	**日期:**	
Bill Boland	[Date]	

1. Age 年龄: __________________________

2. Country of Origin 出生国籍: ___________________

3. Ethnicity 民族: __________________________

4. Gender 性别: ________________________

5. Grade Level 年级: ____________________

6. Years of Teaching Experience 教龄: __________________________

7. Years of Classroom Technology Use 在课堂运用科技的年数: ________________________

8. Subject 科目: __________________________

Thank you very much for your time taking part in this research survey. All answers will remain confidential.
谢谢您抽时间参与该项调研。研究者会对您所有的答案进行保密。

Appendix P

Context Interview Protocol

背景调研访谈方案

Participant Code:	**Project Name:**	**School Code:**
参与者编号:	**参与者姓名:**	**学习编号:**
___________________	Beijing Innovation Project 北京创新项目	___________________
Researcher:	**Date:**	
研究者:	**日期:**	
Bill Boland	[Date]	

Introduction protocol
导入协议

Thank you for taking the time to talk with me about your participation in the the Beijing Innovation Project. I am interviewing participants of this project to better understand their contexts of professional practice. Please answer the following questions as honestly as possible. Thank you for your time.
谢谢您抽空跟我沟通参加北京创新项目。我正对这个项目的所有参与者进行采访，以更好地了解他们在其背景下的行业实践。烦请您尽量诚恳地回答以下问题。谢谢！

Before we start, a few disclosures:
在开始之前，需要向您披露以下几点:

- Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate, or to stop participating at any time.
  这是一项自愿参加的研究。您有权选择参加研究，或在任何时间选择不参与或停止参与。
- This interview will be recorded to have a complete record of our discussion. Is that okay with you?
  本次访谈的讨论内容会被完整记录。您同意吗?

- All content of our conversations will be kept confidential as well as reported in an anonymous manner in the final dissertation.
  我们对话的所有内容将会保密，在最终的论文中的出现也将是匿名的。

The questions in this brief interview are purely related to your school context. The idea is to capture a concrete picture of your school environment. Do you have any questions before we begin?
该简短访谈将会涉及一些跟学校背景相关的问题。目的是为了对您所在学校进行具体的背景了解。在我们开始之前，您有任何疑问吗?

Interview Questions: Context 访谈问题：背景

1) Please describe your school administrative support of your use of technology to support student learning.
   请您描述您在运用科技助力学生学习方面所获得的校园管理层面的支持与协助。

2) Please describe the technology infrastructure of your school. To what technology do you have access in the school and in your classroom?
   请您描述您的学校的技术基建。在校园和自己的班级里，您能运用到哪些科技?

3) Please describe the budget, if any, you receive related to technology to support your classroom instruction.
   请您描述一下能协助您课堂教学的科技方面的预算（如果有的话）。

4) Please describe the school culture related to technology integration.
   请您描述一下将科技融入教学方面的校园文化。

5) Please describe the school professional development related to technology integration.
   请您描述一下学校在将科技融入教学方面的职业发展情况。

6) Tell me about your pre-service professional learning experience regarding technology integration into instruction.
   请您分享关于将科技融入教学方面的一些从业前的专业学习经验。

Appendix Q

Program Implementation: Dose Received Survey

项目实施：接受情况调研

Participant Code:	**Project Name:**	**School Code:**
参与者编号：	**项目名称：**	**学校编号：**
____________________	Beijing Innovation Project 北京创新项目	____________________
Researcher:	**Date:**	
研究者：	**日期：**	
Bill Boland	[Date]	

Thank you for participating in this week's session of the Beijing Innovation Project. Please take two minutes to provide feedback to help us understand your expereince in this program based on your opinions of the session.

谢谢您参与本周的北京创新项目的内容。请您大概花两分钟的时间根据您对本期内容的看法给与反馈，以帮助我们理解您的学习体验。

Session 1: Introduction to 21st Century Skills
第 1 期：介绍 21 世纪技能

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我认为本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信心将本期的知识运用到我的课堂。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5

Session 2: Application of 21st Century Skills
第 2 期：21 世纪技能的运用

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我认为本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信息将本期的知识运用到我的课堂。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5

Session 3: Introduction to Technology Integration in the Classroom
第 3 期：科技融入课堂的介绍

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我认为本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信息将本期的知识运用到我的课程。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5

Session 4: Lesson Planning and Application for Technology Integration in the Classroom
第 4 期：科技融入课堂的教学计划和运用

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我发现本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信心将本期的知识运用到我的课程。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5

Session 5: Unit Planning for Technology Integration
第 5 期：科技融入课程的单元计划

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我认为本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信心将本期的知识运用到我的课程。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5

Session 6: Unit Planning for Technology Integration
第 6 期：科技融入课程的单元计划

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我认为本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信心将本期的知识运用到我的课程。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5

Session 7: Review
第 7 期：复习

	Strongly Disagree 非常不同意				Strongly Agree 非常同意
1) The program purpose for this session was clear. 本期内容的目的很明确。	1	2	3	4	5
2) I understood the purpose of this session. 我理解本期内容的目的。	1	2	3	4	5
3) I found the information in this session useful. 我认为本期提供的信息很有用。	1	2	3	4	5
4) I feel confident I can apply the knowledge from this session in my classroom. 我有信心将本期的知识运用到我的课程。	1	2	3	4	5
5) I have already used information related to this session in my classroom. 我已经将本期相关的信息运用到我的课堂。	1	2	3	4	5
6) Have you been exposed to any other technology-related PD program or any outside technology-focused professional learning opportunity since September?	Yes 有			No 没有	

9 月份后，您有接触任何其他科技相关的职业发展项目或是外部的围绕科技运用开展的学习机会吗？

Appendix R

Beijing Innovation Project Interview Protocol

北京创新项目的访谈协议

Participant Code:	**Project Name:**	**School Code:**
参与者编号:	**项目名称:**	**学校编号:**
____________________	Beijing Innovation Project 北京创新项目	____________________
Researcher:	**Date:**	
研究者	**日期**	
Bill Boland	[Date]	

Introduction protocol
导入协议

Thank you for taking the time to talk with me about your participation in the the Beijing Innovation Project. I am interviewing participants of this project to better understand their experience in the professional development program.Please answer the following questions as honestly as possible. Thank you for your time.
谢谢您抽空跟我沟通参加北京创新项目。我正对这个项目的所有参与者进行采访，以更好地了解他们参加职业发展项目的体验。烦请您尽量诚恳地回答以下问题。谢谢！

Before we start, a few disclosures:
在开始之前，需要向您披露以下几点：

- Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate, or to stop participating at any time.
  这是一项自愿参加的研究。您有权选择参研究，或在任何时间选择不参与或停止参与。
- This interview will be recorded to have a complete record of our discussion. Is that okay with you?
  本次访谈的讨论内容会被完整记录。您同意吗？

- All content of our conversations will be kept confidential as well as reported in an anonymous manner in the final dissertation.
  我们对话的所有内容将会保密，在最终的论文中的出现也将是匿名的。

There are several sections to the interview. The idea is to capture concrete examples of your experience in the program and allow you to elaborate on your opinions in a discussion. Do you have any questions before we begin?
访谈会有不同的区块。目的是为了了解您参加这个项目的体验，允许您在讨论中详细解说您的观点。在我们开始之前，您有任何疑问吗?

(Initial Use and Process Use) ***（初期运用和过程中的运用）***

1) Please describe your use of intervention-related activities during and after the intervention. Also, do you plan to use any related-activities and strategies in the future?
   请您描述您在项目介入过程中和介入完成后运用相关活动的情况。
   另外，您计划在以后运用相关活动和策略吗?
   1a) In case the participant is not able to answer the question with specific examples, the following list of potential activities will be used to stimulate the participants' responses: 21st century skills activities, technology integration activities, technology integration lesson plan, technology integration topics and unit, etc.
   如果参加者没法用具体例子回答问题。可以用以下列出的潜在活动激发参与者进行回答：21 世纪的技能活动、科技融入的活动、科技融入的课程计划、科技融入的主题和单元，等等。

(Teacher Satisfaction with Professional Development) ***（教师对职业发展的满意度）***

2) Please describe your experience in and satisfaction with the professional development intervention. What did you find beneficial? What did you think was not useful?
   请您描述您参加职业发展介入项目的体验和满意情况。对您来说，哪些内容有用，哪些内容无用?

3) What components of the program do you think had the greatest value to support you to use technology to support student learning? What components had the least value?
   您觉得项目的哪些部分最能帮助您运用科技助力学生的学习？哪些部分的最没有这方面的价值?

4) On a scale ranging from 1 (*Strongly Dissatisfied*) to 5 (*Strongly Satisfied*), how would you rate the professional development intervention? Please explain your rating.
   按照从1分（极其不满意）到5分（极其满意）的评分标准，您会如何给该职业发展介入项目评分？请您对您的评分进行阐述。

(Teachers Suggestions for Improvements for the Professional Development Program)
（教师对职业发展项目的改进建议）

5) What suggestions for improvements do you have for the professional development program and why?
   您对职业发展介入项目有哪些改进的建议？为什么？

6) What components of the professional development program were you successful implementing?
   您能顺利运用该职业发展课程中的哪些组成要素？

   6a) What aspects of the professional development program did you struggle to implement? Why?
   该职业发展课程的哪些方面运用起来比较棘手？为什么？

   6b) Why were you able to implement some aspects of the professional development program versus other aspects?
   您能成功运用该职业发展课程中一些方面，而不能运用另一些方面的原因是什么？

(Self-Efficacy) ***（自我效能）***

7) Can you talk about your confidence with using technology? What influences your confidence and why?
   您能谈谈您运用科技的信心吗？是什么影响了您的信心，为什么？

8) Can you explain the ways in which professional development influenced your confidence to support student learning? Why do you think the professional development had this effect?
   请阐述该职业发展项目如何影响您助力学生的学习？为什么该职业发展项目会带来这些效果？

(Technology Competency) ***（科技运用能力）***

9) What effect, if any, did the professional development program have on your technology proficiency to support student learning? Why do you think it had this effect?
   该职业发展项目如何影响了（如有的话）您运用科技助力学生学习的能力？为什么您认为它有这样的效果？

10) What would you describe as the major factors influencing your ability to implement technology in your instruction to support student learning?
   您在课堂教学中运用科技助力学生学习的能力会受到哪些重要因素的影响？

(Technology Instructional Practices) ***（科技教学实践）***

11) Tell me how you think about using technology to support student learning, especially 21st century skills.
请您告诉我您如何看待运用科技支持学生的学习，尤其是培养21世纪技能。

12) What would you describe as the major factors influencing your integration of technology in your instruction to support student learning?
影响您将科技融入您的教学以帮助学生学习的主要因素有哪些?

13) In what ways, if any, did the PD program support you to integrate technology in your instruction to support student learning? Why do you think it had this effect?
该职业发展项目如何影响了（如有的话）您将科技融入您的课堂教学以助力学生学习？为什么您认为它有这样的效果?

(Professional Development)（职业发展）

14) Tell me about your professional development experience while working as a teacher regarding technology integration into instructional practices. Does it meet your needs regarding using technology within your instruction? Why or why not?
请您分享关于您作为老师将科技融入教学实践相关的职业发展经历。这个经历能满足您在实践中运用科技的需求吗？为什么能或为什么不能?

15) Please describe your ideal professional development approach regarding technology integration.
请您描述有关科技运用的理想的职业发展方法。

(21st Century Skills Knowledge)（21世纪技能知识）

16) What impact, if any, did the professional development program have on your knowledge of 21st century skills? Why do you think it had this impact?
该职业发展项目如何影响了（如有的话）您对21世纪技能的了解？为什么您认为它能产生这样的影响?

Appendix S

Educator Technology Self-Efficacy Survey (ETS-ES)

教育工作者科技自我效能调研（ETS-ES）

Participant Code: **参与者编号：** ____________________	**Project Name:** **项目名称：** Beijing Innovation Project 北京创新项目	**School Code:** **学校编号：** ____________________
Researcher: **研究者：** Bill Boland	**Date:** **日期：** [Date]	

Please complete the following survey based on your opinions and the instructions contained in each section. It is important to answer questions as honestly as possible. Thank you for your time.
请您根据每个板块的教学内容和您自己的观点完成以下问卷调研。请您尽最大努力如实回答问题。谢谢您的参与！

Technology Self-Efficacy 科技自我效能

Please indicate your agreement with each of the following statements by marking the appropriate box. 请您根据您的同意程度，在相应的方框内做标记记。

Facilitate and inspire student learning and creativity
促进和激发学生的学习和创造力

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
1.	I empower my students to demonstrate their creative thinking by having them use digital tools to					

	generate new ideas and develop innovative products and processes. 我会赋能学生，让其运用数字工具产生新想法，开发创新产品，形成创新过程，以展示他们的创造性思维。					
2.	I am able to develop technology-enriched learning environments that enable all students to pursue individual curiosities in an active setting. 我能将科技融入学习环境，让学生在学习活动中发展个体的好奇心。					
3.	I regularly involve my students in activities where they use digital tools to plan and manage projects focused on real life events and problems. 我经常让我的学生运用电子工具来计划和管理真实生活事件和解决问题。					
4.	I find it challenging to promote student reflections using collaborative tools. 我发现要让学生运用协同工具来进行反思对我来说是件有挑战的事情。					
5.	I allow my students to only use digital tools that I myself feel comfortable with. 我只允许学生使用我自己能自如运用的电子工具。					

6.	I am unsure of how to set up a classroom where students can express themselves using technology. 我不确定如何创造一个能让学生借助科技来进行自我表达的课堂。					
7.	I actively involve my students in an ongoing examination of their thought processes and patterns, and believe collaborative tools enable them to clarify understanding with each other. 我积极地让我的学生持续性地检验他们的思考过程和模式，而且相信协同工具能帮助他们更好地理解彼此。					
8.	I find it difficult to model collaborative learning for my students. 我发现很难为学生示范协作性的学习。					
9.	I find it challenging to help my students find and use digital tools to solve real-world problems. 我发现要帮助我的学生认识和运用电子工具来解决现实问题是件具有挑战的事情。					
10.	I know how to work with students, colleagues, and others in face-to-face and virtual environments to model the collaborative knowledge construction process. 我知道如何和学生、同事及其他人通过面对面的方式或在虚拟环境中去模拟协作性的知识构建过程。					

II. Design and develop digital age learning experiences and assessments

设计和发展数字时代的学习体验和测评

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
11.	I am not aware of digital tools that allow students to take charge of and manage their own learning in terms of exploring curiosities, setting learning goals and learning strategies, and assessing their own progress. 我没意识到电子工具可以帮助学生在探索学习、设定学习目标、实施学习策略、评估自己的进步等方面实现学习的自我管理。					
12.	I am confident in my ability to collect, analyze, and report data on my student's performance in order to improve my own instruction. 在为提升教学而收集、分析和汇报学生表现的数据方面，我对自己的能力有信心。					
13.	I am confident in customizing and personalizing learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources. 我有信心运用电子工具和资源根据学生多样化的学习风格、学习策略、及学习能力为他们提供因材施教的学习活动。					

14.	I feel overwhelmed when asked to integrate digital tools to promote student learning and creativity. 当被要求运用电子工具来促进学生学习和创造力发展时，我感到应付不过来。					
15.	I train my students to use digital tools to independently manage their own learning objectives, plan their learning strategies, and assess their own progress and results. 我训练我的学生使用电子工具，让他们可以独立地管理自己的学习目标、制定自己的学习策略、评估自己的学习过程和结果。					
16.	I struggle to provide students with multiple and varied assessments that are aligned with both the content and the technology standards. 我努力在遵循内容和科技标准的情况下为学生提供多种多样的测评。					
17.	I feel challenged and overwhelmed when I try to incorporate digital tools to personalize learning activities. 当我尝试将电子工具融入到个性化的学习活动中时，我感觉很有挑战，应付不过来。					
18.	I am confident in my ability to design authentic learning experiences that incorporate contemporary tools and resources. 在基于现代工具和资源的基础上，为学生设计真正的学习体验方面，我对自己的能力有信心。					

19.	I feel a sense of engagement and satisfaction when designing or adapting learning experiences that incorporate digital tools to promote student learning and creativity. 借助电子工具，为学生设计和调整学习体验，以促进他们学习和创造力发展时，我能感觉到自己有一种参与感和满足感。					
20.	I am unsure of how I can use digital tools and resources to design authentic learning experiences for my students. 我不知道如何运用电子工具和资源来为我的学生设计真正的学习体验。					

III. Model digital age work and learning
模拟数字时代的工作和学习

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
21.	I would describe myself as an innovative educator. 我认为我自己是创新型教育者。					
22.	My prior learning has prepared me to use digital tools to collaborate with students, colleagues and parents. 我之前的学习教会了我如何运用电子工具来与我的学生、同事和家长进行协作。					
23.	I feel as though I do not have the time I need to communicate effectively					

	with students, parents, and peers using digital age media. 我感觉即使没时间，我也需要通过数字时代的媒介来与我们学生、家长和同事们保持沟通。					
24.	My lack of technology skills may hinder my ability to acquire and keep pace with new technological advances in the future. 技能的缺乏可能会在未来影响我与科技进步保持同步的能力。					
25.	I value the use of digital tools to locate, analyze, evaluate and use resources to support research, teaching and learning. 我非常重视运用电子工具来获得、分析、评估和运用各种资源，以支持教、研、学。					
26.	I tell students that it's important to use digital tools to locate, analyze, evaluate and use resources to support their own research and learning, but don't typically practice this in my own teaching. 我告诉学生运用电子工具获得、分析、评估和运用各种资源可以帮助他们自己的研究和学习，但是我自己在教学过程中却没有这方面的实践。					
27.	I am confident that the technology skills I have today will help me acquire new skills for the future. 我相信我现在掌握的科学技能能帮助我在未来掌握新技能。					

28.	I feel as though I lack the knowledge and skills I need to teach in our global and digital society. 我感觉自己缺乏全球化和数字化教学所需的知识和技能。					
29.	I feel confident in my ability to effectively communicate relevant information to students, parents, and peers using a variety of digital age media. 我能运用数字时代各种各样的媒介来与我的学生、家长和同事沟通信息。					
30.	I feel like it's a struggle to use digital tools to communicate and collaborate with colleagues, parents, students, and members of the community to support learning in my classroom. 我感觉在我的课堂上为促进学生学习，要运用数字工具去与同事、家长、学生和学习社区的人来进行沟通与协作是一件困难的事情。					

IV. Promote and model digital citizenship and responsibility
提倡和示范数字化公民和其责任

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
31.	I rarely use digital communication tools for my students to interact with other students for online discussions and project teamwork.					

	我很少运用电子沟通工具让我的学生与其它学生进行在线讨论和协作完成学习项目。					
32.	I struggle to provide equitable access to digital tools, curriculum, and online resources. 我努力为学生创造使用电子工具、课程和在线资源的公平机会。					
33.	I feel as though I model and exhibit legal and ethical behavior in our evolving digital culture. 我感觉在这个不断演化的电子文化时代我所展示和示范的行为合乎法律和道德规定。					
34.	I am unsure of the rules of online etiquette (netiquette) and how to appropriately interact with others online. 我不确定有哪些网络礼节，也不确定在网络上与人互动时如何做才算适当。					
35.	I do not regularly teach my students safe, legal and ethical use of online information with regard to author's rights, copyright issues, privacy, cyberbullying and securing data. 我没有经常教我的学生在使用网络信息时要遵守安全、法律和道德规范，包括：著作权、版权、隐私、网络欺凌和确保数据安全。					
36.	I routinely integrate digital communication and collaboration tools for my students to engage with students from other cultures.					

	我常规性地使用电子沟通和协作工具来帮助学生和来自其它文化的学生进行学习交流。					
37.	I frequently model digital etiquette (netiquette) and online social interaction responsibilities. 我经常示范遵守电子时代的礼节（网络礼节）和网络互动的责任。					
38.	I am continually considering and addressing different student needs, including access to software, hardware, curriculum and online resources. 我持续性地考虑和解决不同学生的需求，包括：软件和硬件的使用、获得课程和在线资源的机会。					
39.	I do not fully understand the local and global societal issues and responsibilities in our evolving digital culture. 在我们这个不断演变和发展的数字时代，我没完全理解局部和全球化的社会问题和责任。					
40.	I actively promote, model, and teach the safe, legal and ethical use of online information, including author’s rights, copyright issues, privacy, cyberbullying and securing data. 我积极倡导、示范和教授使用网络信息的安全、合规和合乎道德规范的知识，包括：著作权、版权、隐私、网络欺凌和确保数据安全等。					

V. Engage in professional growth and leadership
参与职业成长和发展领导力

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
41.	I have been described as a good role model for infusing technology into teaching. 我被描述为将科技融入教学的好榜样。					
42.	I consistently engage in professional development that enables me to be confident in demonstrating effective use of digital tools in my classroom. 我持续性地进行职业发展，让自己有信心在课堂上示范有效运用电子工具。					
43.	I sometimes feel overwhelmed when attempting to improve my professional practice by integrating digital tools and resources. 融入电子工具和资源以提高我自己的从业实践时，我有时会感觉应付不了。					
44.	I am somewhat resistant to change, and therefore am slower to integrate a new tool into my teaching until I have seen evidence of effectiveness. 我有些抗拒变化，所以将新的工具运用到我的教学过程中，直到能看到成效之前，我都会比较慢。					

45.	I don't always keep up with trends in the research for practical effectiveness of current and emerging digital tools for teaching and learning. 在寻找现有电子工具或是发展中的电子工具在教与学中能起到的实效性时，我没能与时俱进地跟进潮流。					
46.	I participate in several different 'informal learning communities/networks' in which I seek out ways to learn and grow with new tools for promoting student creativity and collaboration. 我加入了不同的信息化学习社群/网络平台，来学习运用新工具促进学生的创造力和协作能力。					
47.	I struggle to join or maintain any informal learning communities/networks for learning new digital tools for teaching and learning. 我努力想加入不同的信息化学习社群/网络平台，以学习运用新的电子工具来提升教学。					
48.	I rarely discuss educational technology tools and resources with my colleagues. 我很少与我的同事们讨论科技工具和资源。					
49.	I continually evaluate research trends on the practical effectiveness of current and emerging digital tools for teaching and learning.					

	我持续性地评估关于现有和新兴的教学电子工具的研究动态。					
50.	I demonstrate and discuss with my colleagues the effective use of digital resources to improve student learning and the profession of teaching. 我能展示并和同事讨论运用电子资源有益于学生学习和教师上课。					

Appendix T

Technology Beliefs and Competencies Survey

科技信念和能力调研

Participant Code: **参与者编号：**	**Project Name:** **项目名称：**	**School Code:** **学校编号：**
____________________	Beijing Innovation Project 北京创新项目	____________________
Researcher: **研究者：**	**Date:** **日期：**	
Bill Boland	[Date]	

Please complete the following survey based on your teaching experience and the instructions contained in each section. It is important to answer questions as honestly as possible. Thank you for your time.
请您根据自身的教学经验和问卷内容完成以下调研。烦请您尽量诚恳地回答以下问题。谢谢！

Technology Instructional Practices 科技教学实践

Please indicate your agreement with each of the following statements by marking the appropriate box. 请您根据您的同意程度，在相应的方框内做标记。

I. Technology Integration 科技的融入

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意
1.	I integrate computer activities into the curriculum. 在课堂活动中我会使用电脑。				

2.	Technology plays an integral role in supporting content learning in my class. 科技在我教授课程内容时起着必不可少的作用。				
3.	I encourage students to work collaboratively on technology-based activities. 我鼓励学生协作参与融入科技的活动。				
4.	I locate and evaluate educational technologies including software, hardware and online resources for use with my students. 我会寻找和评估能和学生一起使用的教育科技，包括：软件、硬件、在线资源。				
5.	I require students to use a variety of software tools and electronic resources to support learning. 我要求学生使用一系列的软件工具和电子资源来帮助他们学习。				
6.	I use technology to support project- and problem-based learning activities in my classroom. 在我的班级我会借助科技开展项目类型和解决问题型的学习活动。				
7.	I use technology in my classroom to help support the state curricular standards. 我在我的班级借助科技来完成符合国家标准的课程教学活动。				

8.	I use technology to assist me with classroom management and record keeping activities (e.g., grading, attendance). 我运用科技来进行课堂管理和课堂记录（如：评分、考勤）。				
9.	Technology helps me meet the individual needs of a variety of students in my classroom. 科技帮助我满足我班级里不同学生个体的学习需求。				
10.	I encourage my students to use technology to demonstrate their knowledge of content in non-traditional ways (e.g. web sites, multimedia products). 我鼓励我的学生通过非传统的方式展示他们对所学知识的掌握（如：网站、多媒体产品）。				
11.	I use technology to design new learning experiences for students incorporating the unique capabilities of technology. 我运用科技，借助科技特有的功能，为我的学生设计新的学习体验。				

Appendix U

Professional Development Scale

职业发展评分

Participant Code: **参与者编号：**	**Project Name:** **项目名称：**	**School Code:** **学校编号：**
____________________	Beijing Innovation Project 北京创新项目	____________________
Researcher: **研究者：**	**Date:** **日期：**	
Bill Boland	[Date]	

Please complete the following survey based on your teaching experience and the instructions contained in each section. It is important to answer questions as honestly as possible. Thank you for your time.
请您根据自身的教学经验和问卷内容完成以下调研。烦请您尽量诚恳地回答以下问题。谢谢！

Professional Development 职业发展

Please indicate your agreement with each of the following statements by marking the appropriate box. In each statement, "they" refers to previous professional development program that you have attended.
请您根据您的同意程度，在相应的方框内做标记。其中的"它们"指代的是您之前参加的职业发展学习。

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
1.	PD programs help me improve my technology knowledge.					

	职业发展项目帮助我提高了我的科技知识。					
2.	PD programs help me understand how teaching and learning change when particular technologies are used. 职业发展项目帮助我理解了运用特定科学技术能改善教学状况。					
3.	PD programs help me improve my pedagogical knowledge. 职业发展项目帮助我学获得了教学法知识。					
4.	PD programs help me create a technology-enhanced, learner-centered classroom. 职业发展项目帮助我创造了一个科学技术浓厚的，以学生为中心的课堂。					
5.	PD programs help me improve my content knowledge about the subject matter I teach. 职业发展项目帮助我获得了更多我所教授的科目的知识。					
6.	PD programs help me create a learner-centered classroom. 职业发展项目帮助我创造了一个以学生我中心的课程。					
7.	The current professional development programs and activities meet my satisfaction. 目前的职业发展学习活动让我很满意。					
8.	PD programs provide subject-specific technology integration ideas. 职业发展项目提供了科目相关的运用科技的办法。					

9.	PD programs focus primarily on how to merely operate the technology. 职业发展项目重点在解决如何操作科技层面。					
10.	PD programs provide some technology integration ideas but they are too general to be applied easily to my classroom. 职业发展项目提供了一些将科技融入教学的点子，但是内容太宽泛，不能简单地在我的班级实施。					

Appendix V

21st Century Skills Teaching Scale

21 世纪技能教学评分

Participant Code:	Project Name:	School Code:
参与者编号：	**项目名称：**	**学习编号：**
____________________	Beijing Innovation Project 北京创新项目	____________________
Researcher:	**Date:**	
研究者：	**日期：**	
Bill Boland	[Date]	

Please complete the following survey based on your teaching experience and the instructions contained in each section. It is important to answer questions as honestly as possible. Thank you for your time.
请您根据自身的教学经验和问卷内容完成以下调研。烦请您尽量诚恳地回答以下问题。谢谢！

21st Century Skills Teaching Scale 21 世纪技能教学评分

Please rate the importance of each of the following statements by marking the appropriate box.

请您根据您的同意程度，在相应的方框内做标记。

		Strongly Disagree 非常不同意	Disagree 不同意	Neutral 中立	Agree 同意	Strongly Agree 非常同意
1.	Engaging students in collaborating with peers to achieve a goal on a project. 鼓励学生跟同伴协作，达成项目目标。					

2.	Engaging students in oral presentation skills to clearly communicate concepts. 锻炼学生的口头表达能力，以清晰地表达概念。					
3.	Teaching students to use technical writing to clearly communicate topics. 教学生通过技术性写作来清晰地表达主题。					
4.	Engaging students in identifying ‘real-world’ challenges or problems. 鼓励学生发现现实世界的挑战和问题。					
5.	Teaching students to determine an innovative solution to a challenge (e.g. digital animation, oil spill clean-up, application of nanotechnology). 教学生辨析应对挑战的创新方法如：数字动画、石油泄漏清理、纳米技术的运用）。					
6.	Teaching students to evaluate the quality of an idea for a product. 教学生评估某个产品创意的质量。					
7.	Teaching students to evaluate the validity of data or evidence collected from a project. 教学生评估从项目收集的数据或证据的有效性。					

8.	Encouraging students to apply concepts to solve problems in other areas. 鼓励学生运用概念解决其他领域的问题。					
9.	Teaching students to respectfully work with individuals from different cultures. 教学生尊重来自不同文化中的个体与他们开展合作。					
10.	Engaging students in conducting a project that has a value to society. 鼓励学生开展一项具有社会价值的项目。					

Appendix W

WeChat Recruitment Ad

K-6 Teachers Invited to Join Research Study!

My name is Bill Boland, and I am a Johns Hopkins University doctoral student conducting a research project starting September 2018 and inviting all qualified K-6 local and international educators to join. The project involves participation in a free 7-week, 7-session online professional development program and community of practice related to improving teacher instruction with technology to raise student engagement and use of technology, improve student achievement, and support student development of 21st century skills. The program will involve the completion of multiple assignments, including seven discussion group posts, seven journal reflections, four short individual assignments, and multiple community of practice interactions via WeChat. Each session will require approximately three to four hours of participation to complete the related assignments. Additionally, all participants will need to complete pre- and post-program surveys with select volunteers participating in 30 to 60-minute follow-up interviews. The program is a wonderful opportunity to learn more about essential 21st century skills as well as technology integration as well as connect to other educators who have similar interests.

Qualifications:

I am requesting participation from local Chinese and international K-6 educators currently in the classroom. The only criteria are that participants must be able to communicate in English (intermediate level or above for assignment purposes), have access to the internet and can use the social network WeChat, and are willing to participate for the full length of the program until December, completing program assignments and pre- and post-test surveys. Participation requires only 3 to 4 hours per session and is limited to 50 teachers.

If interested, please contact Bill Boland
via wboland1@jhu.edu
or WeChat ID: AmericanBeijing

Appendix X

Johns Hopkins HIRB Letter of Consent

Teacher Participant Code 教师编号:____________________

Johns Hopkins University

Homewood Institutional Review Board (HIRB)

约翰霍普金斯大学
霍姆伍德机构评审委员会（HIRB）

Teacher Informed Consent Form 教师知情同意书

Title: Professional Development's Ability to Impact Technology Use by K-6 Educators: A Mixed Methods Approach

Principal Investigator: Dr. Stephen Pape

Date: September 15, 2018

题目：职业发展对 K-6 教育工作者在科技运用方面的影响：混合式研究方法

主要研究者： Dr. Stephen Pape

PURPOSE OF RESEARCH STUDY:

This is a student research project that is part of her/his Ed.D. dissertation at Johns Hopkins University, School of Education. This study is being conducted by Bill Boland, who is doctoral student at Johns Hopkins University, and Dr. Stephen Pape is his advisor as well as the principle investigator. The purpose of this research study is to investigate the usefulness of an online professional development program coupled with a community of practice to improve K-6 teacher technology self-confidence, technology competency, technology instructional practices, and knowledge of 21st century skills to enhance their students' abilities and provide them necessary 21st century competencies to compete in the global economy. Some 21st century student skills include learning and innovation skills involving critical thinking, communication, collaboration, creativity, as well as being well-versed in new, emerging technologies.

We anticipate that approximately 50 teachers will participate in this study.

本研究旨在探究线上职业发展项目在配有实践交流社区的情况下，在提高K-6老师的科技自我效能、科技能力、科技教学实践，及帮助他们获得教授学生21世纪技能的知识，以提高学生技能，培养学生在21世纪全球经济竞争中的必备能力等方面的作用。

预计将有50名教师参与该研究。

PROCEDURES:

There will be several components for this study:

1. All teachers will participate in brief pre- and post-surveys to collect information regarding their technology self-confidence, technology competency, technology instructional practices, knowledge of 21st century skillsets, and views on professional development. These surveys will have a participant code identifying individuals, which is only accessible by the researcher (Bill Boland) and study team members. Any reported data will be anonymous.
2. All teachers will participate in an online professional development program for seven sessions spanning seven weeks as well as an ongoing community of practice via the social network platform WeChat for the duration of the intervention program, which will involve the completion and submission of multiple assignments, including seven discussion group posts, seven journal reflections, one group and four individual assignments, and multiple community of practice interactions. Each session will require approximately three to four hours of participation to complete related assignments.
3. Some teachers will participate in a semi-structured interview led by the researcher and a bilingual assistant, which will be audiotaped and last approximately 30 to 60 minutes. The research team will ask for and confirm approval from selected participants beforehand.

Some teachers will participate in observations conducted by the researcher and a bilingual assistant, which will be videotaped for later review and comparison to anecdotal notes for accuracy. The research team will ask for and confirm approval from selected participants beforehand.

Time required: You will be asked to participate in this study for the extent of the pre- and post-intervention surveys as well as the length of the professional development program and community of practice, noted as approximately seven weeks divided in seven sessions with a little over 21 hours of workload, approximately three hours per session. Participation in interviews will involve only a select, small group of participants determined at the end of the study. All documents need to be returned as soon as possible to the researcher Bill Boland due to upcoming internal JHU deadlines.

步骤：

该项研究包括几个组成部分：

1. 所有老师将参与前期和后期的问卷调查，提供科技自我效能、科技能力、科技教学实践、对21世纪各项技能的了解、及职业发展观等信息。问卷调研将设置参与编号以区分参与个体，该编号仅供研究者（Bill Boland）使用。所有报告数据将以匿名形式出现。

2. 所有老师将参与一项为期四个月，包含七个模块的线上职业发展培训和干预项目期间在社交平台微信上的持续性社区实践。期间需要完成和提交多项作业，包括：七次群组讨论发帖，七次反思日志、一项小组任务和四次个人作业、多次线上社区实践互动。完成每个模块的任务，大概需要三至四个小时。

3. 一些老师将参与一项半结构化的访谈，由研究者和双语研究助理主导。访谈时长约为30-60分钟，并将录音。研究小组将提前征求所选参与者的同意与确认。

4. 研究者和双语助理将对一些老师进行观察，观察活动将录制成视频资料，供后期回顾和与轶事记录作对比，确保准确性。研究小组将提前征求所选参与者的同意与确认。

时间要求：参与者将受邀参加该项研究的前期和后期问卷调查，参与研究所需时长的职业发展项目和社区实践，历时七个星期，分为七个模块，包括21个多小时的工作量，每个模块所需的时间大概为三个小时。在研究项目结束时，将选取小部分参与者进行访谈。因为约翰霍普金斯大学定有内部的截止日期，所以，所有的文件均需尽快完成并交还给研究者Bill Boland。

RISKS/DISCOMFORTS:

There are no anticipated risks or discomforts to participating teachers. The risks associated with participation in this study are no greater than those encountered in daily life.

BENEFITS:

Potential benefits for participants are the program may increase their technology self-confidence, technology competency, technology instructional practices, and knowledge of 21st century skills necessary for students. It is also free exposure to a professional development program designed by a John Hopkins doctoral student. The benefits to the participating teachers may potentially transfer to the development of students' 21st century competencies, expanding student-centered instruction and enhancing problem-solving and critical-thinking skills. No intervention benefits are guaranteed for participants.

风险与不适：

对老师而言，无预期风险或不适。参与本研究所涉及的风险不会大于日常生活中所面临的其他风险。

益处：

参与者将获得的潜在益处有：该项目能帮助他们提高科技自我效能、科技运用能力、科技教学实践能力，掌握学生应具备哪些21世纪技能的知识。参与者也将免费参与一

项由约翰霍普金斯大学的博士生设计的职业发展项目。收获这些益处后，参与研究项目的老师可能将这些益处惠及到学生，帮助培养学生的21世纪技能、拓展以学生为中心的教学实践、培养学生的辩证思维和解决问题的能力。项目不对研究者获得的干预益处做保障。

VOLUNTARY PARTICIPATION AND RIGHT TO WITHDRAW:

Your participation in this study is entirely voluntary. You choose whether to agree to take part in the study. If you decide not to participate, there are no penalties, and you will not lose any benefits to which you would otherwise be entitled.

You can stop participation in the study at any time, without any penalty or loss of benefits. If you want to withdraw from the study, please contact Bill Boland via phone or email: (+86) 176 0169 5685, wboland1@jhu.edu.

If we learn any new information during the study that could affect whether you want to continue participating, we will discuss this information with you.

自愿参与和退出权：

本研究属完全自愿参与。您可自行决定是否参与研究。如果您决定不参加，不会涉及任何处罚，也不会损失任何应得的权益。

您可以在任何时间选择停止参与研究，不会有任何处罚或权益损失。如果您想从研究中退出，请通过电话或邮件联系Bill Boland: (+86) 176 0169 5685, wboland1@jhu.edu.

CONFIDENTIALITY:

Any study records that identify you will be kept confidential to the extent possible by law. The records from your participation may be reviewed by people responsible for making sure that research is done properly, including members of the Johns Hopkins University Homewood Institutional Review Board and officials from government agencies such as the Office for Human Research Protections. (All of these people are required to keep your identity and the identify of your students confidential.) Otherwise, records that identify you will be available only to people working on the study, unless you give permission for other people to see the records.

All videotapes and measures will be examined by the Principal Investigator and research affiliates only (including those entities described above). No identifiable information will be included in any reports of the research published or provided to school administration. A participant number will be assigned to all surveys.

Surveys will be collected through an online medium, which will not include identifiable information other than basic demographic information.

Video data of the interviews may be transcribed by a study team member (transcriptionist), who will de-identify all transcripts by deleting all names from the transcript and only a participant number or pseudonym will be included on these transcripts.

All research data including printed online surveys, interview transcripts, and videotapes will be kept in a locked office. Electronic data will be stored on the PI's computer, which is password protected. Any original tapes or electronic files will be erased and paper documents shredded, ten years after collection.

Only group data will be included in publication; no individual achievement data will ever be published.

保密性：

任何能识别您身份的研究记录将严格保密，受法律保护。您参与研究的记录可能将被负责确保研究以适当的方式进行的人员审阅，包括：约翰霍普金斯大学霍姆伍德机构评审委员会（HIRB）成员和政府机关的公务人员如：人力资源保护办公室。（这些审阅人员将被要求对您的身份和学生的身份进行保密。）所有能识别您的研究记录将仅供该项研究的研究人员查看，除非您准许将其给他人查看。

所有的录像资料和测量仅供主要研究人者和研究附属机构（包括以上提到的单位）查看。绝无具有身份识别性的信息出现在将来要发表出来的研究报告或是上交给学校管理层。参与编号将应用于所有问卷调研。

问卷调研结果通过线上平台收集，除基本的人数统计信息外，不包含任何身份识别性的信息。

访谈的视频资料可能由外部代理机构（录音打字员）进行文字脚本记录，该记录员将把文字脚本中的名字删除，仅保留参与者编号或化名，使脚本不具身份识别性。

所有的研究数据包括纸质调研问卷和录像资料将保管在上锁的办公室。电子版的资料将存储在 要研究者的电脑上，受密码保护。数据收集十年后，所有原始影像资料或电子文档将被清除，所有纸质文档将碎纸销毁。

只有小组的数据会包含在发表物中；任何个体获得的数据将不被发表。

COMPENSATION:

You will not receive any payment or other compensation for participating in this study.

补贴：

该研究不会为您提供任何报酬或是补贴。

IF YOU HAVE QUESTIONS OR CONCERNS:

You can ask questions about this research study at any time during the study by contacting Bill Boland via phone or email: (+86) 176 0169 5685, wboland1@jhu.edu. If you have questions about your rights as a research participant or feel that you have not been treated fairly, please call the Homewood Institutional Review Board at Johns Hopkins University at (+001) 410 516-6580.

如果您有任何问题或者疑虑：

在研究期间，如您有任何疑问，您可以打电话或是发邮件联系研究者Bill Boland: (+86) 176 0169 5685, wboland1@jhu.edu。如果您对自己参与研究的权利有疑问或觉得自己在研究中所受待遇不公，请通过拨打电话(+001)410 516-6580联系约翰霍普金斯大学的霍姆伍德机构评审委员会.

SIGNATURES

WHAT YOUR SIGNATURE MEANS:

Your signature below means that you understand the information in this consent form. Your signature also means that you agree to participate in the study. By signing this consent form, you have not waived any legal rights you otherwise would have as a participant in a research study.

签名

签名的意义：
您的签名意味着您理解该同意书的内容。 您的签名也意味着您同意参与研究。签署同意书后，您并不会被剥夺作为研究参与者应享有的所有法律权利。

____

Participant's Signature 参与者签名 **Date 日期**

____

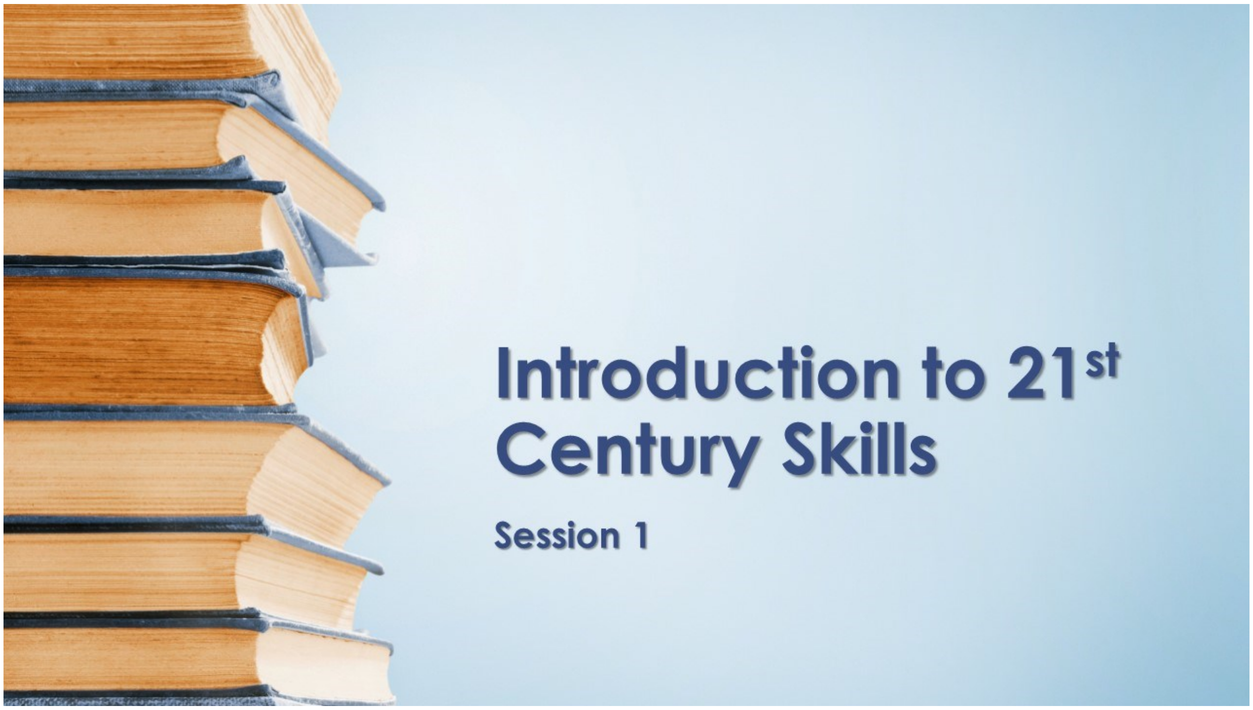
Signature of Person Obtaining Consent 获得同意的一方签名 **Date 日期**

(Investigator or HIRB Approved Designee)

(调查者或由 HIRB 批准的其它制定人员)

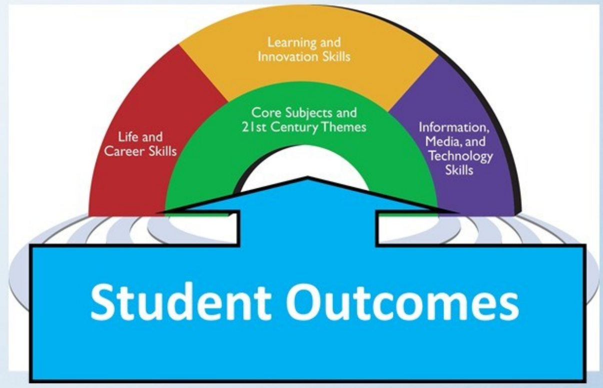
Appendix Y

Session 1 Presentation



21st Century Student Outcomes

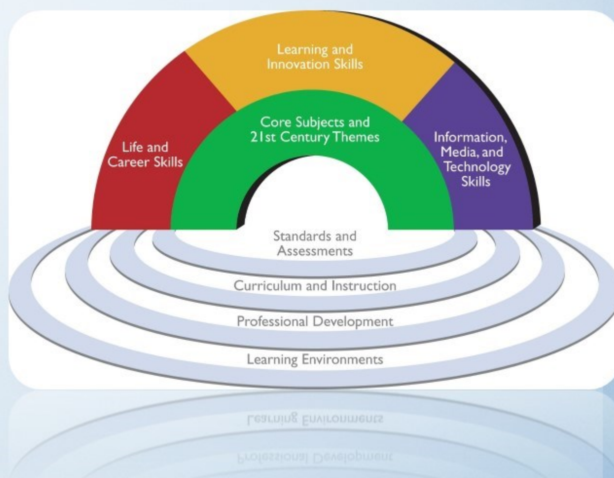
- Content Knowledge and 21st Century Themes
- Learning and Innovation Skills
- Information, Media, and Technology Skills
- Life and Career Skills



(Partnership for 21st Century Learning, 2018)

What are 21st century skills?

- Defined in different ways by different organizations.
- P21 Framework for 21st Century Learning includes
  - Student outcomes
  - Support systems



(Partnership for 21st Century Learning, 2018)

Content Knowledge and 21st Century Themes

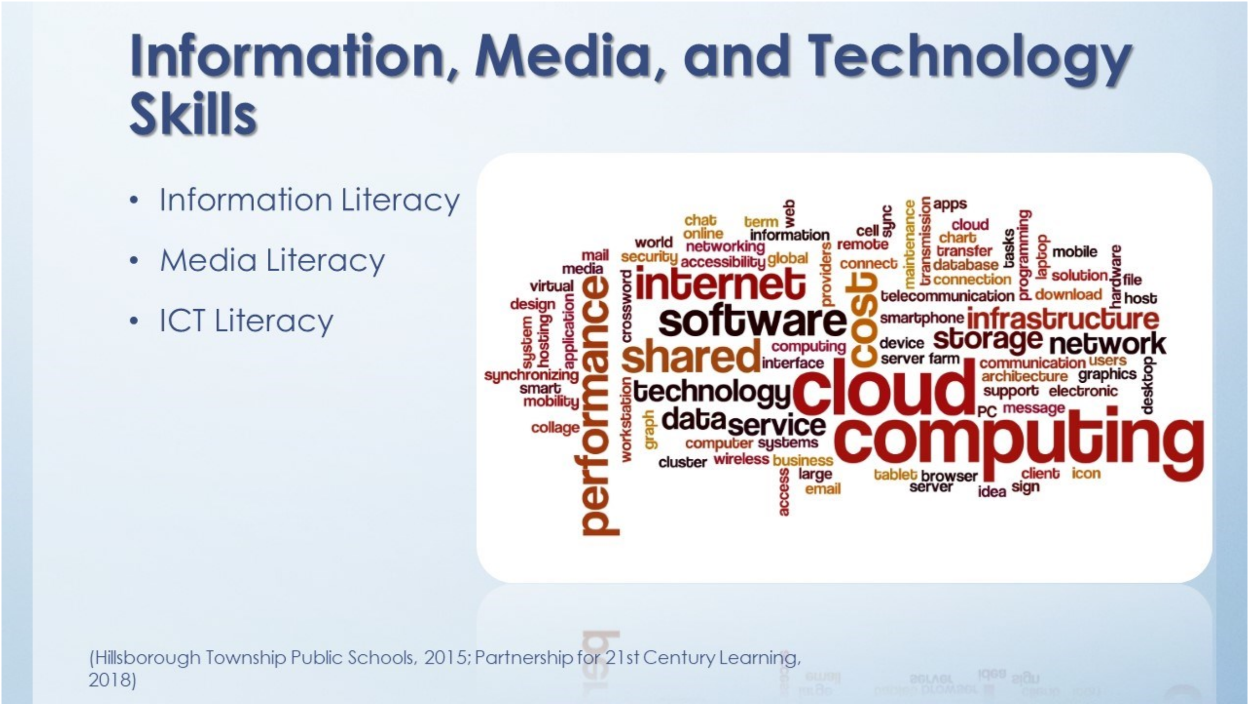
- Mastery of fundamental subjects and 21st century themes is essential for students in the 21st century.

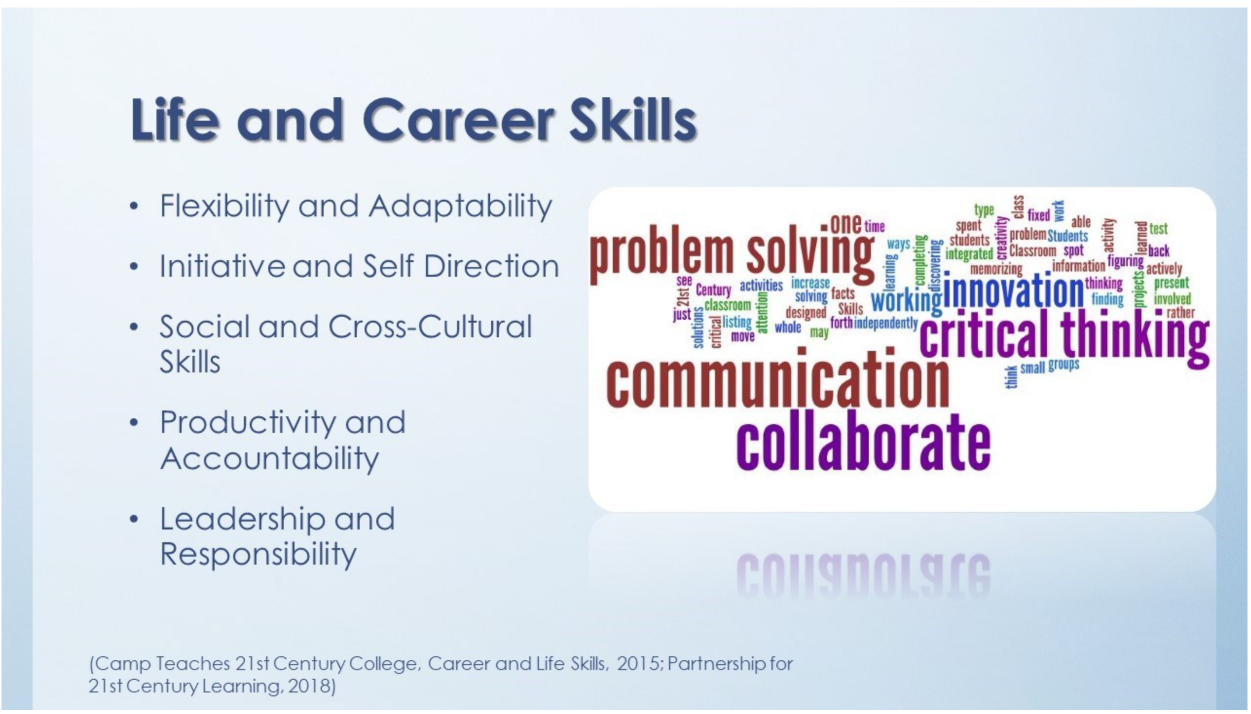
(Partnership for 21st Century Learning, 2018; Tenorio, 2008)

Learning and Innovation Skills

- Skills that separate students who are prepared for increasingly complex life and work environments in the 21st century, and those who are not
- Necessary skills to be competitive in the 21st century global workforce

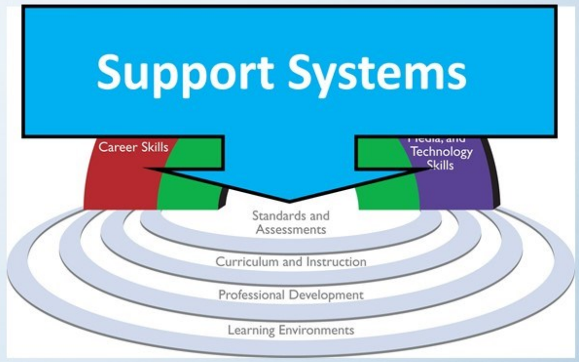
(Mullins, 2013; Partnership for 21st Century Learning, 2018)


Information, Media, and Technology Skills
• Information Literacy
• Media Literacy
• ICT Literacy
cloud computing
performance
internet
software
shared
technology
data
service
cost
infrastructure
storage
network
(Hillsborough Township Public Schools, 2015; Partnership for 21st Century Learning, 2018)


Life and Career Skills
• Flexibility and Adaptability
• Initiative and Self Direction
• Social and Cross-Cultural Skills
• Productivity and Accountability
• Leadership and Responsibility
problem solving
innovation
critical thinking
communication
collaborate
working
(Camp Teaches 21st Century College, Career and Life Skills, 2015; Partnership for 21st Century Learning, 2018)

21st Century Support Systems

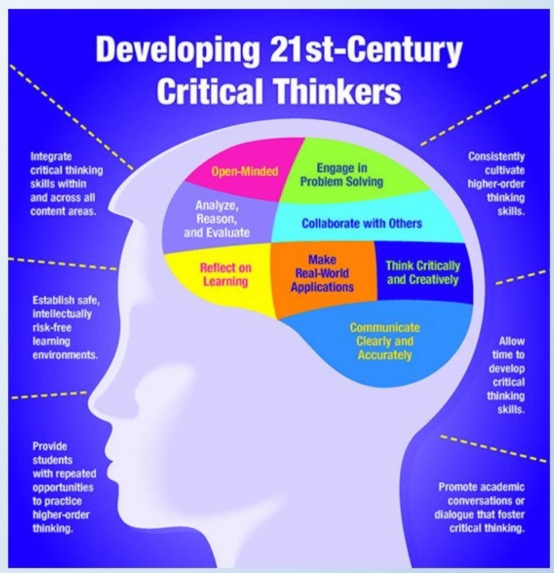
- 21st Century Standards
- Assessment of 21st Century Skills
- 21st Century Curriculum and Instruction
- 21st Century Professional Development
- 21st Century Learning Environments



(Partnership for 21st Century Learning, 2018)

Why are 21st century skills important?

- Work has changed
- Expectations have changed
- Society and demands have changed



(ACTE, 2010; Ertmer & Ottenbreit-Leftwich, 2010; Gu, Zhu, & Guo, 2013; Partnership for 21st Century Skills, 2005; Partnership for 21st Century Learning, 2018; Pedró, 2006; Reynolds, 2016)

Why are 21st century skills important?

- Essential Questions:
  - What must students know and be able to do to be productive and successful in today's world?
  - What must teachers know and be able to do to cultivate an environment conducive to fostering these skills in their students?

References

Association for Career and Technical Education (ACTE). (2010). *Up to the challenge: the role of career and technical education and 21st century skills in college and career readiness.* Retrieved from http://www.p21.org/

Camp Teaches 21st Century College, Career and Life Skills. (2015). Retrieved from https://www.cheleyfoundation.org/impact/camp-teaches-21st-century-college-career-and-life-skills/

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*, 255-284. doi:10.1080/15391523.2010.10782551

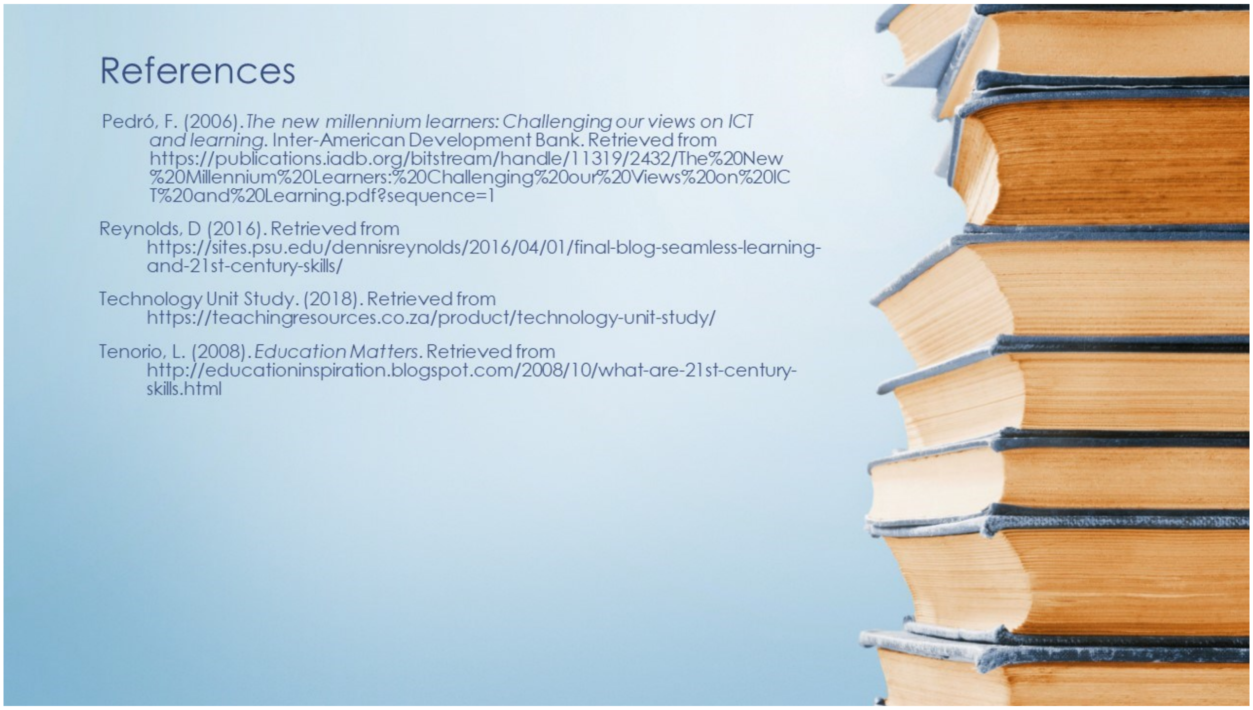
Gu, X., Zhu, Y., & Guo, X. (2013). Meeting the "digital natives": Understanding the acceptance of technology in classrooms. *Educational Technology & Society, 16*(1), 392–402. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=a9h&AN=85178218&site=ehost-live&scope=site

Hillsborough Township Public Schools. (2015). Retrieved from https://www.htps.us/services/technology_literacy

Mullins, H. (2013). *NCCS Student Advisory Places Emphasis on the 4Cs*. Retrieved from http://nccscurriculum.org/2013/11/21/nccs-student-advisory-places-emphasis-on-the-4cs/

Partnership for 21st Century Skills. (2005). *21st century skills, education and competitiveness: A resource and policy guide.* Retrieved from http://www.p21.org/

Partnership for 21st Century Learning (2018). Framework for 21st Century Learning. Retrieved from http://www.p21.org/about-us/p21-framework


References
Pedró, F. (2006). The new millennium learners: Challenging our views on ICT and learning. Inter-American Development Bank. Retrieved from https://publications.iadb.org/bitstream/handle/11319/2432/The%20New%20Millennium%20Learners:%20Challenging%20our%20Views%20on%20ICT%20and%20Learning.pdf?sequence=1
Reynolds, D (2016). Retrieved from https://sites.psu.edu/dennisreynolds/2016/04/01/final-blog-seamless-learning-and-21st-century-skills/
Technology Unit Study. (2018). Retrieved from https://teachingresources.co.za/product/technology-unit-study/
Tenorio, L. (2008). Education Matters. Retrieved from http://educationinspiration.blogspot.com/2008/10/what-are-21st-century-skills.html

Appendix Z

Session 1 Intervention Core and Supplementary Materials

The following is a summary of the Beijing Innovation Project's core and supplementary materials for Session 1, which includes article links, video links, as well as discussion and journal prompts.

Session Component	Description
Core Articles	1. A quiet education revolution worldwide is giving kids the skills to be 21st-century citizens Anderson, J. (2016, December 3). *A quiet education revolution worldwide is giving kids the skills to be 21st-century citizens*. Retrieved from https://qz.com/845834/a-stealthy-education-revolution-worldwide-is-giving-kids-the-skills-to-be-21st-century-citizens/ [Accessed 7 Jul. 2018]. 2. P211 – Partnership for 21st Century Learning – Framework for 21st Century Learning Partnership for 21st Century Learning. (2018). *Framework for 21st century learning - P21.* Retrieved from http://www.p21.org/our-work/p21-framework
Supplementary Articles	1. Applied Education Systems: 21st Century skills are 12 abilities that today's students need to succeed in their careers during the Information Age Applied Educational Systems. (2018). What are 21st century skills?. Retrieved from https://www.aeseducation.com/careercenter21/what-are-21st-century-skills 2. 21st Century Skills Map American Council on the Teaching of Foreign Languages. (2011, March). *21st century skills map.* Retrieved from https://www.actfl.org/sites/default/files/pdfs/21stCenturySkillsMap/p21_worldlanguagesmap.pdf

Videos	1.	How to Build a 21st Century Classroom YouTube. (2014, May 15). *How to build a 21st century classroom.* Retrieved from https://www.youtube.com/watch?v=zkVxow4Rqus
	2.	Introduction to 21st Century Learning with Helen Soule YouTube. (2016, July 12). *Introduction to 21st century learning with Helen Soule.* Retrieved from https://www.youtube.com/watch?v=6-NF1FQz2Mk
	3.	The Four C's – Making 21st Century Education Happen YouTube. (2012, February 23). *The four c's: Making 21st century education happen.* Retrieved from https://www.youtube.com/watch?v=ghx0vd1oEzM
Discussion Group Prompt	1.	First, provide a personal introduction of yourself as well as eight nouns describing who you are. Second, discuss your impression of 21st century skills before viewing the session material. After reviewing the material, how did that impression change? Can you think of examples of current 21st century skills you cultivate with your students?
Journal Reflection Prompt	1.	Please briefly outline what you expect from this project, your reasons for participating, and what you hope to learn and improve. Additionally, provide one example of a skill you've had difficulty fostering in your classroom and how/if the session material has provided you any guidance that may help you overcome this obstacle

Appendix AA

Session 1 Assignment

Session 1: Introduction to 21st Century Skills

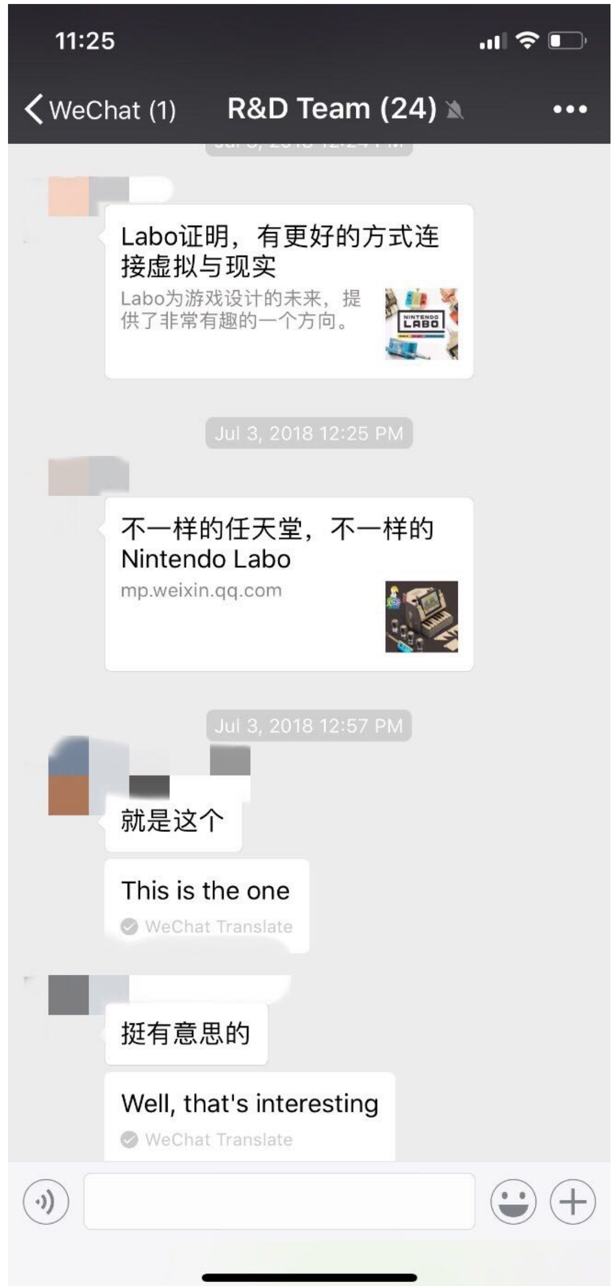
Objective: Provided with information regarding 21st century skill concepts, you will be able to identify the 21st century skills that are important for students and create a list of these skills and how they can apply to your students.

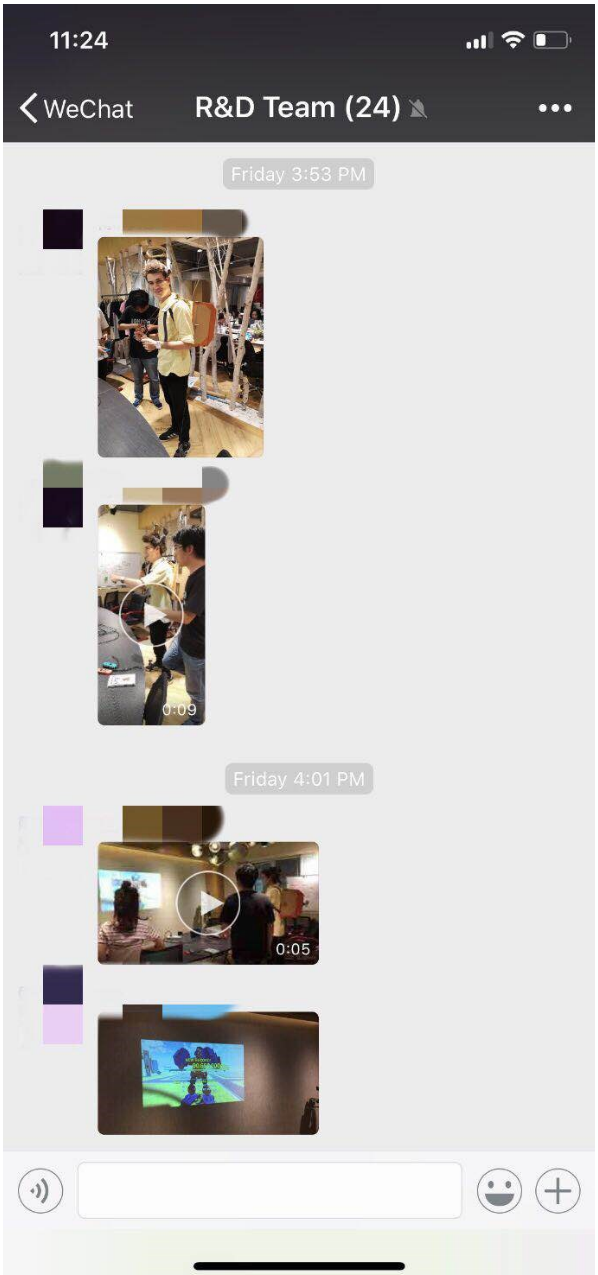
Please list 21st century skills in the provide spaces and type a brief description of an activity you can use to foster this skill in your students that involves technology to some degree.

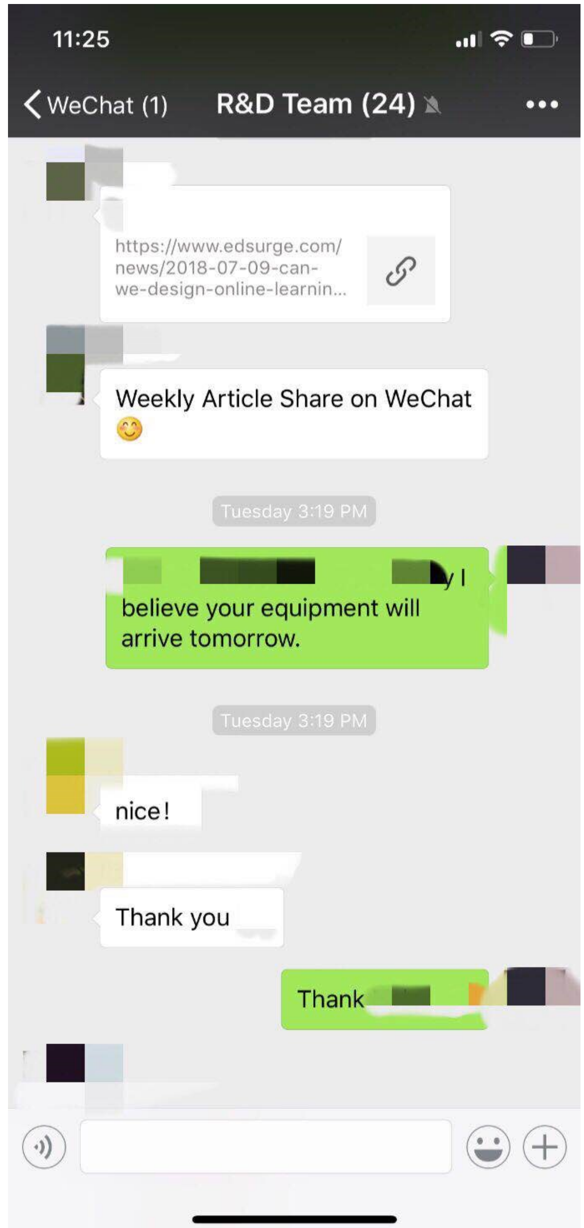
21st Century Skill	Activity Description

Appendix AB

WeChat Screenshot Examples




11:24
WeChat
R&D Team (24)
Friday 3:53 PM
0:09
Friday 4:01 PM
0:05


11:25
WeChat (1)
R&D Team (24)
https://www.edsurge.com/news/2018-07-09-can-we-design-online-learnin...
Weekly Article Share on WeChat
Tuesday 3:19 PM
[redacted] I believe your equipment will arrive tomorrow.
Tuesday 3:19 PM
nice!
Thank you
Thank [redacted]

Bill Boland
Beijing, China
Cell: 186.1844.7317
Email: billboland@gmail.com

A highly educated, ambitious, and efficient educational leader is searching for new job opportunities in the China K-12 education market. With a wealth of experience in R&D, leadership and management, business development, curriculum design, creative design, regional and campus management, HR recruitment and supervision, English Department leadership and implementation, and a variety of other skill sets, Bill is a strong, multi-talented candidate for a variety of upper management educational leadership positions. With current doctoral fellowships from the prestigious Johns Hopkins University School of Education, he can provide a wealth of educational technology experience as well as connections to leading experts in the field of education, both in China and abroad.

EDUCATION EMPLOYMENT/EXPERIENCE

Vice President of Research & Development Beijing, China
Kids Academy, www.KAFamily.com *March 2018 to June 2019*

- Managing the international R&D Department (separate from the Etonkids Educational Group R&D Department) of a B2B and B2C early childhood education platform company, which includes five teams: International R&D, Chinese R&D, Creative Design Studio, Professional Learning Lab, and R&D Project Management. All teams are composed of approximately 50 plus team members.
- Leading international business development outreach, cooperation, and partnership efforts, including multiple key potential multi-million dollar initiatives with easily recognizable international education organizations.
- Advising and guiding the development of key project initiatives as well as international and local business partnerships, including both educational curricula and products, offline and online.
- Executing and supervising multiple curriculum creation projects, involving print and multimedia as well as online development components.
- Supervising special company research projects, including the development of AR, VR, AI, and other partnership projects.
- Collaborating on the online construction of a teacher and principal professional development platform, including the creation of the online learning framework, guiding the development of hundreds of videos and multiple courses, and streamlining the online teacher professional learning process.
- Supporting the development of a curriculum delivery platform and child assessment framework and system through research and content support as well as expert guidance.
- Supervising internal and external creative graphic design, illustration, and film production projects for online and offline curricula and products as well as all company sales, marketing, and commercial initiatives.
- Liaising with outside partner companies on special educational product development projects.

Senior Research & Development Director Beijing, China
Etonkids Educational Group, www.etonkids.com *July 2014 to June 2019*

- Managing the R&D Team of a four hundred fifty-million-dollar international education company with 52+ bilingual kindergartens and one K-12 international school.
- Developing, negotiating, and executing international and local business development of internal special projects as deemed by the CEO.
- Overseeing multiple English and Chinese curriculum creation projects for the Academic Departments as well as all internal and external research initiatives.
- Supervising the internal creative design team providing all design support to the entire company, including graphic, video, WeChat, and website design.
- Advising the development of the key, premier International/Bilingual sector within Beijing through project guidance and execution.
- Leading all international-focused marketing initiatives as well as the company visual identity development and advising the Marketing Division on all local campaigns.
- Executing the nationwide curriculum development of the Extracurricular Services team.
- Researching and organizing the West Coast expansion plan.
- Liaising with outside partner companies on special educational product projects.
- Acting as editor of an 80-page, bi-monthly academic journal *KIDS* (30 issues).
- Authored over 30 children's books for internal as well as Amazon.com distribution

▪ **Acted as Temporary International Bilingual Chief Regional Principal** from **February 2015 to October 2015**, supervising eight international bilingual campuses and 16 principals, eight foreign and 8 Chinese. Campuses consisted of over
▪ **Directed the International HR Division** regarding all nationwide foreign employee. recruiting, including headhunting, contracts visa processing, internal HR support, etc., from **November 2014 to April 2016.** The International HR Division was merged into and taken under the guidance of R&D during this period due to an inability of the broader Human Resources Department to achieve recruitment and staff relationship goals.
▪ **Supervised the English Department** regarding all curriculum implementation, training, and teacher-related issues on multiple occasions working with a staff of over 350 English teachers, specifically from **August 2012 to August 2013** and **January 2015 to August 2015.**

Research & Development Director Beijing, China
Kids Academy, www.KAFamily.com *October 2016 to March 2018*

- Managed the international R&D Department (separate from the Etonkids Educational Group R&D Department) of a B2B kindergarten platform company, including a small team of 12 individuals.
- Advised the development of the key development project initiatives as well as international and local business partnerships.
- Executed and supervising multiple curriculum creation projects, involving print and multimedia.
- Supervised special company research projects, including the development of partnership projects.

- Liaised with outside partner companies on special educational product development projects.

Research & Development Manager Beijing, China
Etonkids Educational Group, www.etonkids.com *September 2012 to July 2014*

- Managed the R&D Team of an international education company with 40+ bilingual kindergartens and one K-12 international school.
- Provided instructional support and training in Etonkids classrooms and worked with the students through educational research initiatives and projects.
- Supervised multiple curriculum creation projects as well as other special projects for the CEO and Academic Departments.
- Executed international business development projects as directed by the CEO and wrote multiple outside company business plans for the CEO.
- Liaised with outside partner companies on special educational product projects.
- Provided Marketing, HR, and Education Services support.
- Acted as editor of an 8-page, bi-monthly academic journal *KIDS* (19 issues).

Research & Development Officer Beijing, China
Etonkids Educational Group, www.etonkids.com *December 2011 to Sept. 2012*

- Coordinated multiple projects involving the creation of educational products related to curriculum and instruction.
- Researched, developed, and wrote educational app content, curricula, and stories.
- Wrote children's storybooks for iPad release.

English Teacher Beijing, China
Etonkids Educational Group, www.etonkids.com *June 2011 to December 2011*

- Provided primary English instruction and support to a classroom of over twenty students ages 3 to 6 in a Montessori learning environment.
- Organized and wrote lesson plans as well as led daily English Circles and small groups.

Enrichment Program Instructor Syracuse, NY
Boys and Girls Club *September 2010 to June 2011*

- Taught an after-school program for inner-city youth at Franklin Elementary for a group of fifteen students.
- Instructed an enrichment program of the arts, focusing on theater, art, and film.

Independent Contractor Syracuse, NY
College Tutor *April 2009 to August 2010*

- Tutored a Wagner college student five to seven hours a week in English, American Literature, and English composition. Assisted with prep work for upcoming courses.

EF English First Wuhan, China
English Teacher/ESL Teacher *June 2008 to April 2009*

- Instructed toddler, beginning, intermediate, and adult levels overseas in Wuhan, China in both private and primary schools (1st, 5th, and 6th grades in the primary school).

- Supervised classes of up to thirty-eight students and wrote own lesson plans/exams.
- Wrote, produced, directed, and acted in teacher's Christmas ESL show for the entire school.

Independent Contractor Syracuse, NY
High School Tutor *September 2007 to June 2008*

- Tutored several high school students in English, Life Science, American History, Spanish, and Math (Algebra) as well as general writing and spelling two hours daily.

OTHER EMPLOYMENT/EXPERIENCE

First Look Studios Los Angeles, CA
Manager of Post Services *December 2005 to Oct. 2006*

- Managed the Post Services department of the studio. Dealt with producers and vendors with incoming materials and maintained the studio's online database.
- Supported the marketing department, creating TV Spots, Trailers, and EPK.
- Acted as a Post Production Supervisor and supported the Vice President of Production.

EDUCATION

Johns Hopkins University *Baltimore, Maryland*
Doctorate of Education: Educational Technology and Instructional Design Summer 2019

Arizona State University *Tempe, Arizona*
Masters of Early Childhood Education: Curriculum & Instruction August 2015

University of Southern California *Los Angeles, CA*
Bachelor of Arts in Cinema-Television Production May 2005

CERTIFICATIONS

Bethel University *St. Paul, MN*
IB Certificate in Teaching & Learning, Primary Years March 2016

North American Montessori Center *Vancouver, Canada*
International Montessori Teaching Diploma, P-K/K, 2.5-6 July 2015

i-to-i TEFL, www.i-to-i.com/tefl *Leeds, United Kingdom*
Teaching English as a Foreign Language (TEFL); March 2008
Teaching English as a Second or Other Language (TESOL);
Grammar Specialist Certificate

PROFESSIONAL DEVELOPMENT

Harvard University Graduate School of Education *Boston, Massachusetts*
Differentiating Instruction for English Language Learners May 2015

NAEYC Annual Conference *Multiple*
Attended annual conference lecture multiple years 2013 - 2018

HONORS

- Co-produced the 2007 Academy Award Winning Best Live Action Short, *West Bank Story.*
- Wrote and published 30+ bilingual children's books (available on Amazon.com under a pseudonym).
- Recipient of the John Hopkins Edward Franklin Buchner Fellowship in Education (2016-17 and 2017-18)
- Recipient of the John Hopkins Online Fellowship in Education (2017-18)
- Dean's List all four years, Magna Cum Laude at USC/ASU.
- Co-host of IPEC 2014 (International Preschool Education Conference in Beijing, China).
- Published multiple education articles in *That's Beijing, Beijing Kids, City Weekend,* etc.
- Picked by the Director of Studies of EF English First as Best Teacher of Winter.
- NAEYC Member 2012-2018.

SKILLS

- Conversational Spanish/Basic Chinese.
- Extensive knowledge of filmmaking, film editing, and design software.